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FIT BUT IDLE OR FRAIL BUT ACTIVE?

ESTIMATING LATENT HEALTH-RELATED WORK CAPACITY AMONG ELDERLY ITALIANS

FRANCESCO GIANOLA, 3088

A project carried out on the Master in Economics Program under the supervision of:

Prof. Pedro Pita Barros

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Fit but Idle or Frail but Active?

Estimating Latent Health-related Work Capacity Among Elderly Italians

Francesco Gianola

Abstract

This paper estimates if and to what extend older Italians could work, given their health status. It does so by comparing actual labour force participation rates to counterfactual participation rates. One participation rate is constructed through a non-parametric method, comparing actual rates with past ones, holding death rate, a proxy for health, constant. The other method creates a counterfactual rate by comparing younger and older individuals with the same health status. The results of both analyses point towards spare work capacity among the Italian male and female workforce of 5.97 years or 57% in terms of additional participation rate (for males) depending on the method, years and age. Results are in line with findings for developed countries following the same approach.

Keywords: *Ageing, Work, Health*

In memory of you, Marcello.

1 Introduction

The sustainability of pension systems is a recurring concern for policymakers in developed countries. Italy-the main country of this analysis- is not an exception: stagnating labour productivity, high inactivity rates among the eligible workforce, an increasing life expectancy, low fertility rates and a high level of government debt, in 2017 at 131.8% of GDP (ISTAT, 2018), are all pointing towards a high pressure on the pension system. In numbers, if compared to other Euro and G7 countries, Italy is the one with the lowest average labour force participation rate over the period 1977-2016 and only ranks above Turkey if considering the OECD and G20 countries (OECD, 2018b). Moreover, compared to other Europeans, Italians, according to EUROSTAT (2018b), are among the least fertile (1.34 children per woman vs 1.60 for European Union average in 2016) and among the ones who can historically expect

to live the longest lives (25.5 years compared to the average 60-year-old European which is expected to live 24.0 years in 2016 according to EUROSTAT (2018a)). All this is coupled with stagnating labour productivity per hour since 1996 (OECD, 2018a) and a high incidence of public pension expenditures on public finances amounting to 16.3% of GDP in 2015; almost double as the average OECD country (OECD, 2017).

Italian policymakers are and were well aware of both demographic short and long-term trends and the gravity of the issue from a budgetary balance perspective. Therefore, in the past 25 years, there have been several reforms of the Italian pension system (European Commission, 2018) in the attempt to counter the above-mentioned trends. Especially the *Fornero-Monti* reform in 2011, in a situation of severe economic and political crisis, entailed sudden, profound interventions including (i) drastically raising the statutory retirement age e.g. by 7 years from 2012-2018 for women, (ii) moving towards equalising retirement ages for men and women, and (iii) improving the mechanism for adjustments in the future e.g. indexing retirement age to life expectancy (Barr and Diamond, 2015; Brambilla et al., 2017).

The crucial question that remains after these interventions is if the increases in statutory retirement age are a feasible policy: Are Italians actually able to work longer years? Or, put differently, does the gain in years of life translate into actual capacity to work?

This paper provides some preliminary answers to the question through two approaches, both estimating how much more older people could work, given their health, compared to another group of people whit similar health.

In the first approch, developed by Milligan and Wise (2015), henceforth referred to as Milligan-Wise method, a counterfactual labour force participation rate is constructed using data from earlier years. Participation rates from current individuals are then compared to earlier rates holding health status constant. More specifically, this non-parametric method approximates health by using death rates i.e. the probability to die within the next year. The question it answers is how much an individual of a certain age, gender, in a given year and at a given death rate works, when compared to an individual of another year with the same death rate. The underlying reasoning is that if individuals in 2016 retire with a given death rate (again, a proxy for health status) but at this same death rate individuals in the past e.g. 1977 worked, then latent work capacity is at hand.

The second method used to estimate spare work capacity among elderly follows the original work of Cutler et al. (2013), henceforth Cutler et al. method. Here, unrealized work capacity is examined by estimating a labour force participation model with health indicators as explanatory variables on a sample of individuals that are not affected by any financial incentives provided by pension schemes (aged 50-55). The estimated coefficients are then used to make an out-of-sample prediction for older age groups (aged 55-74) with the construction of a counterfactual participation rate. The question that the model answers is how much older people of a certain age would work if they worked as much as people from a younger, but not very different age group with the same health.[1]

Both methods point towards significant additional health capacity to work at older ages among men and women in Italy. This result is in line with analyses of other papers following the same approach for developed countries (Spain: García-Gómez et al. (2016); US: Coile et al. (2016); UK: Banks et al. (2016); Netherlands: Kalwij et al. (2016)) used as blueprints for this work. The trend, looking at the most recent years, seems to be one of diminishing spare work capacity if compared to decades before. The reason behind it is the increasing participation rate, raising faster than gains in life expectancy. This, in turn, suggests that far-reaching pension reforms are going in the right direction *if* the goal is to exploit spare work capacity of elderly. The main concerns are twofold. On the one hand, estimations might capture only population averages veiling some potential, marked heterogeneity in the capacity to work especially in the first method employed. Individuals working in a white-collar job might be able to prolong their working lives to a higher extent than the ones in blue-collar occupations. On the other hand, endogeneity issues in the estimation of effects might lead to unreliable conclusions, particularly in the Cutler et al. method.

Several further caveats are worth mentioning: (i) Health is the only factor of interest here determining whether an individual can work or not. Of course, there are several other relevant elements that influence the decision whether to work or not: caring responsibilities, a suitable employment, (macro) economic conditions, labour demand, financial incentives and many more. In other words, albeit crucial for the decision to retire, this paper does

[1]Note about terminology: employment rate in this paper measures people that are actually employed. This is a different concept than the one of activity rate or (labour force) participation rate, used interchangeably here. The ladder represent all the people that can work i.e. the employed, the ones who are looking for a job (unemployed) and some other minor categories which are conventionally not always classified as employed i.e. people in military service etc. While measuring two related concepts, the distinction is crucial for this work.

not aim to analyse the effect of (the change of) financial incentives on work or the effects of automation on the labour market but focuses exclusively on the aspect of health. Moreover, (ii) it is important to keep in mind that this work draws on other working papers that perform a similar estimation for other countries. Thus, some methodological choices are specifically made for a cross-country comparability. In addition, (iii) results obtained are to be interpreted with caution since they rely upon (strong) assumptions. They should not be taken as exact measurements but rather as rough approximations. Finally, (iv) considering the importance of the topic it seems also essential to stress that the paper does *not* make any normative judgement whether elderly should work longer but only measures if there is some latent work capacity.

The remainder of this paper is structured as follows. Section 2 describes the Italian evolution of labour force participation rates and health status. Section 3 and Section 4 present the Milligan-Wise method and the Cutler et al. method respectively, starting from the data and summary statistics, continuing with their implementations and the results obtained as well as some robustness checks and sensitivity analyses, where appropriate. Section 5 compares the results among the two methods and to findings from other papers. Section 6 summarizes and concludes.

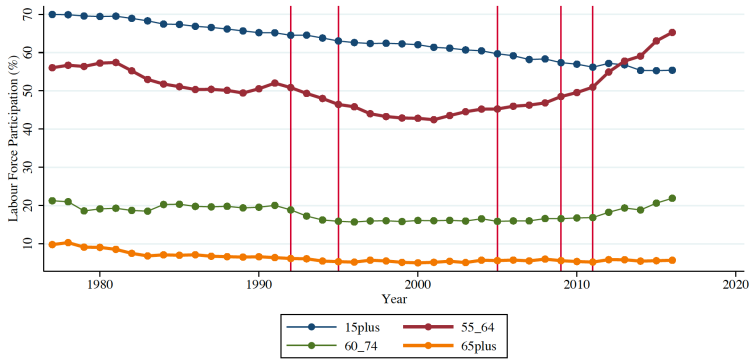
2 Trends in Labour Participation and Health

Labour force participation rate, defined as the sum of the employed and unemployed population over the total population in working age (above 15 years old), for Italians both men and women, is lower than in other developed countries and remained fairly stable over the period 1977-2016.[2] What leads to this regularity are two prevailing, offsetting trends: For males, the rate is steadily declining from 70% to 56% while the participation rate for women is constantly increasing from 28% in 1977 to around 40% in 2016 as can be seen in Figure 1 and Figure 2. There are various explanations for these movements: For males, the main drivers are longer education, different financial incentives to retire, while the cultural change about the role of women in society paired with higher education is certainly one of the

[2]Labour force rates are computed manually on raw data from the Italian Labour Force Survey obtained from ISTAT. More details about data in Section 3. The reader interested in the construction of the rates is invited to proceed to the Supplementary Appendix, henceforth Appendix A under subsection A.1.

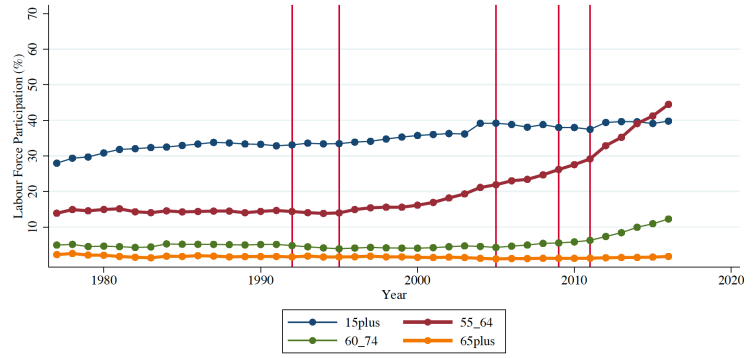
main driving forces behind the trend in the increased participation for women (García-Gómez et al., 2016). This cultural change is also the reason why in the Milligan–Wise method below, an analysis of women's ability to work is not implemented since the lower work capacities in the past are not due to health.

Figure 1: **Male Labour Participation Rates for different Age-groups**



Source: Author's own computations based on the Italian Labour Force Survey.

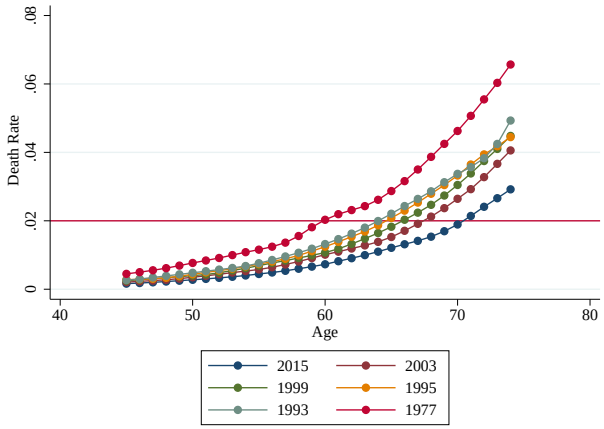
Figure 2: **Female Labour Participation Rates for different Age-groups**



Source: Author's own computations based on the Italian Labour Force Survey.

The figures also depict participation rates for subgroups of the population in working age. For men aged 55 up to 65, participation fell from around 57% in 1977 to a low of 42% in 2001 before rising again and reaching 65% in 2016. A similar convex line is observable for the age group 60-75, although much less pronounced. For females, figures look differently. Activity rate for women aged 55 up to 65 fluctuated around 15% until the early 2000s, when it started to soar hitting 45% in 2016, increasing more than threefold in just 15 years! The graphs also mark some reforms of the Italian pension system since the 1990s (vertical red lines) which reduced substantially the financial incentives to retire early of in the previous pension system. However, the lengthening of working life driven by the increase of the statutory retirement age, did not substantially affect the individuals older than 65 until recently.

Figure 3: **Death Rates for Males in Different Years by Age**



Source: Author's own computations based on ISTAT's Mortality Rates.

Figure 4: **Self Assessed Health for Males in Different Year-Groups by Age**

Source: Author's own computations based on Italian Household Survey.
Note: For the period 2013-15 data by the exact age are not available. Dots indicate the mean of the 5(10)-year age-group.

Figure 3 depicts the age gradient in mortality as well as the pronounced trend towards lower death rates. In 1977, men aged 60 experienced an annual mortality rate of 0.2%. That mortality rate is just reached at the age of 71 in 2015, a substantial decrease(see horizontal red line in Figure 3). Death rates depicted here come from the Italian Statistical Office ISTAT (2018) however, other sources like the Human Mortality Database (HMD) (Shkolnikov and Barbieri, 2018) not displayed in these figures, have also been taken and compared, with practically the same results.

Figure 4 shows trends in self–assessed health (SAH), expressed as the percentage of fair/poor health for men aged 50 up to 75 from 1993-2015, based on own computations from the annual

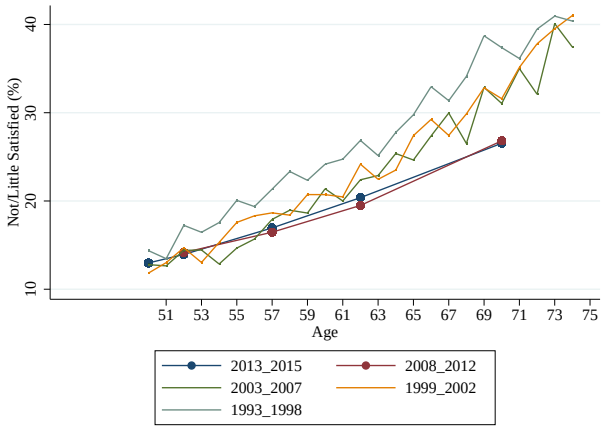
Indagine multiscopo sulle famiglie a representative household survey about aspects of daily living with, depending on the year, up to around 780 variables for an average, relevant sample size of roughly 18,000 individuals per year (huge variation in size). There seems to be slight improvements in SAH until around 2003 after which there is a reversal. This is reassuring for the choice for death rate as proxy for health since it confirms that a lower death rate goes hand in hand with at better perceived health. Nonetheless, results should be interpreted with care, since they might be noisy due to changing sample size as well as the relatively short time span. Regrettably, to the author's knowledge, there is no comprehensive survey for Italy where SAH is recorded before 1993. Moreover, the SAH question changed in coding and phrasing several times during the period and is not released from 2005-2013. Hence, several adjustments were necessary. This is also why the dotted lines indicate the average of the respective 5-year (or 10-year) age-group. Results after 2013 should thus be regarded with particular care. SAH being a self reported health measure, it is very likely that other factors influence it e.g. the economic crisis hitting Italy in 2009-2013 might influence the reporting of SAH downward.

Roughly 43% of men aged 62 report themselves to be in fair or poor health in 1993-1995 (see vertical line in Figure 4). This number decreases until 2001-2003 when, somewhere after, there seems to exist a reversal in trend towards worse health. What, however, is evident, is the deteriorating SAH with the advancement of age which is somewhat stronger in 1993 compared to more recent years (steepness of the lines).

To overcome the problem of the change in question format and coding, an alternative measure of health is presented in Figure 5: The satisfaction with health status in the year preceding the interview, assessed from 1= *"not at all"* to 4= *"satisfied"* available in the same survey. The correlation between SAH and health satisfaction is 0.57 for the relevant sub-sample further reinforcing the choice of SAH and consequently death rate as a proxy for health.

To sum up, in Italy–as in other countries (Netherlands, US, Spain, UK) SAH worsens with age. Health (or at least death rates) has improved over time. Hence, the claim that a reduction in mortality does not necessarily translate into additional work capacity if the changes do not go hand in hand with better health status, seems at least partially accounted for. The international evidence is inconclusive whether changes in mortality are translated into compression or expansion in morbidity (Kalwij et al., 2016).

Figure 5: **Health Satisfaction for Males in Different Year-Groups by Age**



Source: Author's own computations based on Italian Household Survey.

Before turning to the Milligan-Wise method, a further layer of analysis is reported.[3] Given the profound socio-economic differences between the North and South of the Italian peninsula, the country is divided into three repartitions: North, Center and South. While the same pictures with employment rates show differences between North and South especially at younger ages considered here, with the North having substantially higher rates for both men and women, this is not found for activity rates. Moreover, fluctuations in the North are generally more pronounced than in the South and the spread in the death rates (higher in the North compared to the South in 1977) is closing (see A.1 and A.2 for the respective graphs, as for some of the subsequent results by repartition).

3 Work Capacity Using the Milligan-Wise Method

Mortality rates, used as an approximation of health (because of long span availability and objectivity, contrary to SAH, which has a strong reporting bias among different countries making an inter-country comparison more problematic (Bound, 1991)) are taken from ISTAT and the HMD. Raw data for the construction of the activity rates by gender and age come from the Italian Labour Force Survey provided by ISTAT upon request and entail roughly 36 Mio. observations. Data are available from 1977 to 2016.

The implemented method consists of the following. The first step is to calculate labour force

[3] Here and for the Milligan-Wise Method.

participation rate in percentages for each year, by age and gender. More specifically, the criterion for deciding whether an individual should be counted as active or not, corresponds to a situation of search for employment or to a status of actual work (employed). All *"retired"* or *"unable to work"* are considered to be inactive. The underlying reasoning is that someone who works or is looking for a job, is also able to work. Note, however, that due to different changes in coding and reporting of the variables some categories of response had to be classified. Usually, these categories are just a small part of the relevant sample and hence do not affect estimates substantially.

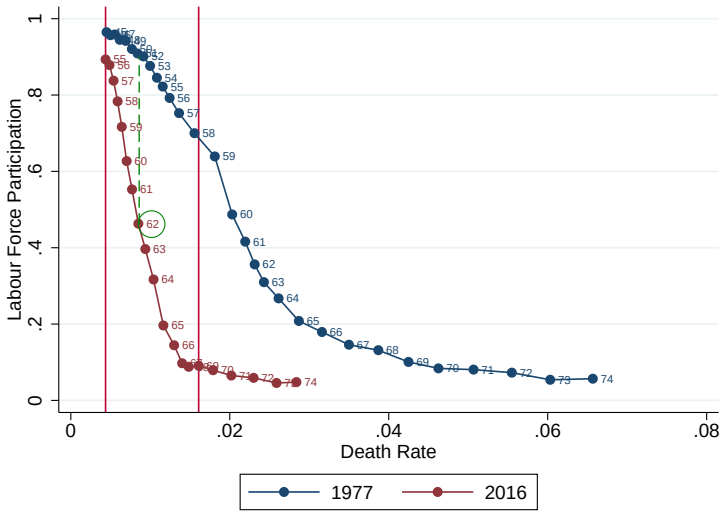
In a second step, the obtained rates are used for constructing the activity-mortality relationship as follows: one takes a given individual with the corresponding actual activity rate and looks at the respective mortality rate for that individual. Then the mortality rate is matched among the mortality rates in the year of reference and the respective participation rate that goes together with the same (closest) mortality rate in the reference year is compared to the original participation rate. Put differently, the idea is to compare participation rates holding death rate, i.e. indirectly health status, constant.[4]

The approach is illustrated in Figure 6. Take a 62-year-old male in 2016. His probability to die in the next year is 0.0084989. If comparing it to an individual with the same (very similar) death rate in 1977 one finds that this is 0.0083982 (error of approx. 0.00001) and corresponds to a 51-year-old male in 1977 with a participation rate at that time of around 91% (in graphical terms the vertical green line between the two points). This means, according to the reasoning presented here, that for the same health status (proxied by death rate) more individuals worked in the past. After a simple subtraction (46%-91%) this results in a spare work capacity of 45% compared to 1977. Had a 62 year-old in 2016 had the same health as in 1977, he would have, on average, worked more. Unfortunately, data provided for the period 2004-2013 are not available by age but grouped by 5-year age class. This is also why, contrary to other papers, the base year chosen is not 2010 but the most recent one. A further reason for 2016 is that a more recent year includes, at least partially, the first consequences from the 2011 reform.

Table 1 presents the results from age 55 to 69 i.e. how much more males in 2016 could

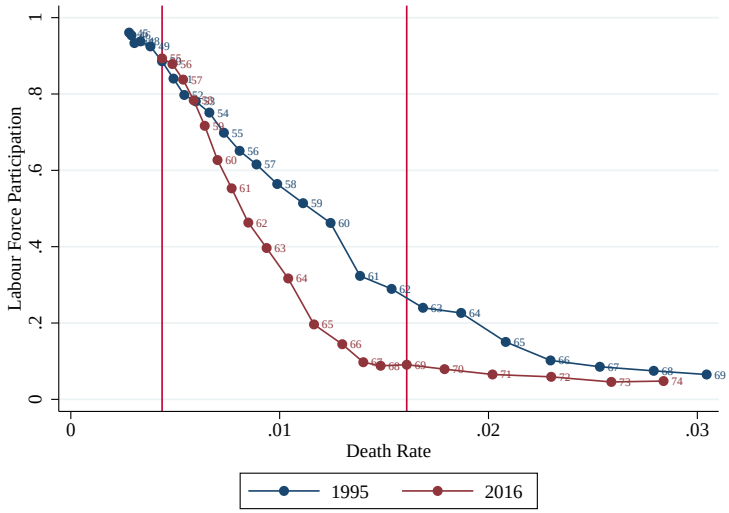
[4]Note that in this context individual does not refer to a specific individual but is to be intended as a representative individual. For instance, a 60-year-old male in 1977 does not stand for a specific person but for a stylized entity. As mentioned before, rates for women are not used in this method.

Figure 6: **Participation- Mortality Relationship Comparing 2016 to 1977**



Source: Author's own computations based on Italian Labour Force Survey and ISTAT Mortality Rates.

Figure 7: **Participation- Mortality Relationship Comparing 2016 to 1995**



Source: Author's own computations based on Italian Labour Force Survey and ISTAT Mortality Rates.

have worked had they worked as much as men with the same death rate in 1977. At age 55, an additional 7.14% could have worked, which amounts to an average 0.0714 additional work-years i.e. one additional year for 7.14% of individuals aged 55. At age 60, the estimation leads to 31.5%. Repeating this analysis at each age and cumulating the amounts of work years, the potential additional work-year capacity is 5.97 years. In terms of Figure 6 above, this would be approximately the numerical solution to the distance between the closest dots

Table 1: *Additional Work Capacity 2016 Using 1977 Employment-Mortality Relationship in %*

Age	Death Rate 2016	Participation Rate 2016	Participation Rate 1977	Difference	Capacity
55	0.43709	89.33	96.47	7.14	
56	0.48647	87.85	95.68	7.83	
57	0.53774	83.76	95.87	12.11	
58	0.58863	78.34	94.47	16.13	
59	0.64128	71.67	94.47	22.80	
60	0.70238	62.70	94.19	31.50	
61	0.7701	55.28	92.06	36.78	
62	0.84989	46.30	90.88	44.58	
63	0.93752	39.65	90.12	50.47	
64	1.04084	31.68	84.53	52.85	
65	1.16445	19.64	82.22	62.58	
66	1.29968	14.45	79.24	64.79	
67	1.40058	9.74	75.26	65.52	
68	1.48336	8.80	70.01	61.20	
69	1.60841	9.08	70.01	60.92	5.97 years

Note: Capacity is the cumulated difference from age 55 to 69.

iterated for each dot i.e. ideally the integral between the two curves.[5]

Another dimension that can be inferred of the method is the ability to work for specific age groups as shown in Table 1, using 1977 as the comparison year: at age 62, an additional 45% of men could be active at age 65, an additional 63% etc. These estimates can be compared to the results of the Cutler et al. method.

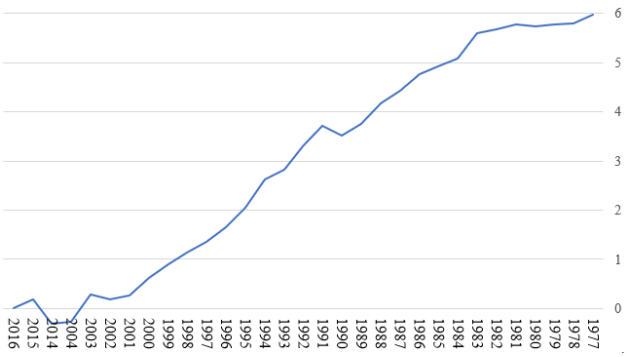
The main assumptions of the Milligan-Wise Method are: First, (i) the estimation implicitly assumes that all mortality gains can translate into additional work capacity which might not be true if workers are living longer but are not in good health in those gained years of life. A second concern (ii) is that an additional year of life does not automatically translate into a full additional year of work. Here, the solution is straightforward as one can multiply the figure above by two-thirds, arriving at an estimate of 3.94 years rather than 5.97 years. This number is suggested by Coile et al. (2016) referring to recommendations of the *National Commission on Fiscal Responsibility and Reform* regarding the share of life spent in work and retirement. Another issue (iii) that arises in implementing this method is the choice of year to use for comparison to the present. Ideally, the comparison is a year of fully utilized work capacity. In this regards 1977 seems a suitable candidate. For instance, using as a comparison year 1995 instead of 1977 leads to substantially different results: here spare

[5]It is, however, strictly speaking, not exactly the integral between the curves due to the discrete mortality rates. A linear interpolation method could have been used to create the curve between the data points. However, this was not implemented due to the -at least for the spirit of this exercise- small error (on average 0.00023). A liner interpolation would also have led to some estimation errors.

ability to work is substantially less and even negative for some ages as can be inferred from Figure 7. Put differently, comparing current activity rates by mortality to those in the recent past suggests little spare work capacity: recent increases participation rates among older men (see Figure 1 and Figure 2) are (almost) sufficient to keep pace with the improvements in one-year mortality rates.

Figure 8 represents estimated additional work capacity as a function of the base year. For years close to 2016, the estimated additional employment capacity is small. The difference between the two years is not large because mortality does not change much over a short period of time. If, for example, one looks at 2004, negative latent work capacity compared to 2016 is at hand. But, as shown in the years 1995 and 1977, when going further back in time, the estimated additional capacity is substantially larger. This is because mortality has over time improved more than participation rate increased. In summary, the analysis based on the Milligan-Wise method suggests a significant amount of additional work capacity for Italian men, particularly if earlier years are taken as a comparison. If more recent years are compared to 2016 spare work capacity is shrinking and becoming even negative suggesting that in the last years participation is catching up with the diminished mortality. Implemented policies seem to have effectively eroded latent work capacity.

Figure 8: **Latent Work Capacity as a Function of Reference Year 2016**



Source: Author's own computations based on Italian Labour Force Survey and ISTAT Mortality Rates.
Note: Years 2005-2013 have been omitted because data are only available by age group.

Robustness and Other Specifications

The above-described method was estimated with different specifications and subsamples in order to address various concerns that arise. First, the construction of the labour force participation rate was done with several different specifications. This to account for the

ambiguity of some coding. The general results are robust to this change and all point towards similar spare work capacity.

As Italy is historically a heterogeneous country, the South of the country lagging behind the North in many important socio-economic indicators, an estimation of the model that divides Italy into three repartitions, North, Centre and South, was carried out to see if there are relevant differences in the results. While the three repartitions slightly differ along certain dimensions, the results do not show significant differences across regions in terms of latent capacity to work. Also, mortality rates from different sources have been used to double check results. Robustness checks with the estimation by age-class where carried out to check whether for the years 2004- 2013 the values are reasonable (see A.2 for some results).

4 Work Capacity Using the Cutler et al. Method

This method attempts to answer the question: How much could individuals work if compared to slightly younger individuals with the same health? Data used in this method are obtained from the Survey of Health, Ageing and Retirement in Europe (SHARE), a European longitudinal survey following a representative national sample of individuals above the age of 50 through six waves starting from 2004 to 2014 (Börsch-Supan et al., 2013; Börsch-Supan, 2018; Gruber et al., 2014). Wave 3 is not used in this analysis since it is a retrospective survey and is unfit to capture health transformations. The sample used for the regression includes 818 observations for males and 1281 for females, while the observations used for the construction of the counterfactual participation rate consists of 6038 females and 4903 males.

A description of the variables used in the subsequent analysis is provided in Table 2. Summary statistics of the data are displayed in Table 3 for males and Table 4 for females. Despite some minor differences, the three most relevant dissimilarities between men and women are: i) men tend to smoke substantially more than women both at time of the interview and before in all age groups ii) women throughout the sample have substantially more complications with mobility iii) women seem to have difficulties in daily activities. Noticing the differences can be important for future research to understand the underlying dynamics of health and employment.

Table 2: **Description of the Variables**

Variable	**Definition**
employed	Dummy equal to 1 if the individual is participating in the labour force (or employed)
health_exc	Dummy equal to 1 if the individual states to be in excellent health
health_vgood	Dummy equal to 1 if the individual states to be in very good health
health_good	Dummy equal to 1 if the individual states to be in good health
health_fair	Dummy equal to 1 if the individual states to be in fair health
health_poor	Dummy equal to 1 if the individual states to be in poor health
mobilit2	Dummy equal to 1 if the individual has at least one arm function and fine motor limitations
ADLany	Dummy equal to 1 if the individual has difficulty with an activity of daily living (ADL)
IADLany	Dummy equal to 1 if the individual has difficulty in instrumental activity of daily living
eurod	EUROD mental health index
heartat	Dummy equal to 1 if the individual ever experienced AMI
stroke	Dummy equal to 1 if the individual ever experienced stroke
cohlester	Dummy equal to 1 if the individual ever experienced cholesterol
lungdis	Dummy equal to 1 if the individual ever experienced lung disease
cancer	Dummy equal to 1 if the individual ever experienced cancer
highblpr	Dummy equal to 1 if the individual ever experienced high blood pressure
diabetes	Dummy equal to 1 if the individual ever experienced diabetes
osteopor	Dummy equal to 1 if the individual ever experienced osteoporosis
obese	Dummy equal to 1 if the individual is obese
smokerform	Dummy equal to 1 if the individual is a former smoker
smokecurr	Dummy equal to 1 if the individual is a current smoker
educ_lessthHS	Dummy equal to 1 if the individual has less than high school education
educ_hs	Dummy equal to 1 if the individual has high school education
educ_collegemore	Dummy equal to 1 if the individual has college education or more
hhsize	Size of the household
partnerinhh	Dummy equal to one if living together with spouse /partner

Table 3: **Summary Statistics Males**

	Age 50-54	Age 55-59	Age 60-64	Age 65-69	Age 70-74
employed	0.93	0.72	0.32	0.06	0.02
educ_ lessthHS	0.17	0.24	0.35	0.43	0.57
educ_ hs	0.71	0.66	0.55	0.49	0.36
educ_ collegemore	0.13	0.10	0.10	0.08	0.07
hhsize	3.13	3.13	2.76	2.46	2.26
partnerinhh	0.81	0.90	0.91	0.89	0.87
health_ poor	0.02	0.04	0.05	0.07	0.10
health_ exc	0.14	0.11	0.10	0.09	0.06
health_ vgood	0.26	0.22	0.17	0.14	0.12
health_ good	0.45	0.45	0.43	0.39	0.38
health_ fair	0.14	0.19	0.25	0.31	0.34
mobility2	0.19	0.26	0.31	0.41	0.49
IADLany	0.02	0.04	0.04	0.07	0.11
ADLany	0.02	0.03	0.04	0.05	0.09
obese	0.13	0.16	0.17	0.18	0.16
heartat	0.04	0.06	0.09	0.14	0.16
highblpr	0.22	0.31	0.34	0.45	0.47
cohlester	0.14	0.18	0.18	0.25	0.24
stroke	0.01	0.01	0.02	0.03	0.04
diabetes	0.05	0.08	0.11	0.16	0.16
lungdis	0.03	0.04	0.05	0.07	0.12
cancer	0.01	0.02	0.03	0.03	0.04
smokecurr	0.31	0.27	0.23	0.17	0.13
eurod	1.92	1.91	1.91	2.25	2.39
smokerform	0.52	0.55	0.55	0.56	0.51
osteopor	0.01	0.04	0.02	0.04	0.06
N	818	1,135	1,298	1,311	1,159

Table 4: **Summary Statistics Females**

	Age 50-54	Age 55-59	Age 60-64	Age 65-69	Age 70-74
employed	0.60	0.41	0.12	0.02	0.00
educ_ lessthHS	0.21	0.34	0.48	0.61	0.68
educ_ hs	0.66	0.58	0.45	0.34	0.29
educ_ collegemore	0.13	0.09	0.07	0.05	0.03
hhsize	3.18	2.85	2.46	2.18	2.01
partnerinhh	0.83	0.85	0.82	0.76	0.68
health_ poor	0.04	0.06	0.07	0.11	0.15
health $_exc$	0.11	0.09	0.06	0.05	0.03
health_ vgood	0.26	0.19	0.15	0.10	0.09
health_ good	0.39	0.40	0.42	0.38	0.31
health_ fair	0.20	0.26	0.30	0.36	0.43
mobility2	0.33	0.43	0.49	0.61	0.71
IADLany	0.05	0.07	0.11	0.14	0.23
ADLany	0.04	0.05	0.06	0.09	0.13
obese	0.15	0.16	0.19	0.20	0.21
heartat	0.02	0.03	0.04	0.08	0.11
highblpr	0.19	0.28	0.38	0.47	0.52
cohlester	0.11	0.20	0.24	0.28	0.29
stroke	0.01	0.01	0.01	0.02	0.03
diabetes	0.04	0.06	0.09	0.13	0.15
lungdis	0.02	0.04	0.03	0.05	0.08
cancer	0.04	0.04	0.04	0.05	0.05
smokecurr	0.22	0.18	0.13	0.10	0.06
eurod	2.74	2.86	2.97	3.27	3.48
smokerform	0.36	0.34	0.28	0.21	0.17
osteopor	0.06	0.09	0.12	0.18	0.21
N	1,281	1,548	1,653	1,547	1,290

The estimation of latent work capacity here is implemented through three-step process: (i) Pursuing the methodology from other works, the following linear probability model (LPM) is estimated on a sample of 50-54-year-old individuals split by gender. This is done to estimate the counterfactual rate. Data are pooled from all waves for sample size reasons which implies that the relation between health and retirement decision is assumed to stay constant over time:

$$Participation_i = \alpha + \beta_1 \; health_i + \beta_2 \; X_i + \varepsilon_i \tag{1}$$

where *Participation* is a dummy variable equal to 1 if the individual is capable of work i.e. employed or unemployed, *health* is a set of variables capturing different health measurements, including several dummy variables for physical limitations, self-perceived health, limitations of activity and X is a set of variables including educational level, household size and other controls (for a complete description see Table 2).

The coefficients obtained from the model (1) are then (ii) used to make a linear prediction of the probability of being active for the other sub-samples (age 55-74) out of which predicted participation is constructed. In the last step (iii), the actual participation rate and the predicted one are compared, and latent work capacity determined.

The above-mentioned model is estimated in two versions. The first version includes all the variables as single regressors, and the second one contains a health index as a summary measure of the health status, following the approach proposed by Poterba et al. (2013). This is necessary since sample size for individuals aged 50-54 is not enough to estimate all the coefficients for the large set of health conditions i.e. a potential dimensionality problem in the data. The index is constructed as follows: the first component of the principal component analysis is taken, and the scores are predicted for every observation.[6] Then, signs are inverted, and the scores are divided into percentile ranks to ease interpretation (for the list of variables used and their first components see Table 5). The index is constructed in several ways to capture different facets of the data. First, the PCA analysis is made by wave. This allows to capture a specific time dimension and, hence, changes over time. The rank is made differentiating by gender and wave using the Hazen method for ranking.[7] The second way of constructing the index is also a PCA analysis by wave but ranks, instead of being constructed by gender and waves, are built over the whole sample. This allows to capture a different feature of the data since here individuals are ranked among all and not in their group i.e. their relative positions change. In any case, the index has to be interpreted as higher values indicating better health. Poterba et al. (2013) demonstrate that the health index is strongly related to mortality and future health events.

Table 6 summarizes the output of the regression using all health variables. Table 7 shows the results for the model estimated with the summary index. All regressions have been made with clustering at individual level for the computation of standard errors since some individuals are used repeatedly. Overall, the signs of the association between health and education and the probability of being active for both men and women are as expected: more educated (especially for women) individuals and those in better health are more likely to be employed. However, there are some differences in the estimates between men and women. For example, indicators of household size are only significant for women. Estimates using the health index are similar to the ones using the large set of health variables. Being in the 60th percentile

[6]The variables have some minor changes with respect to the original index. This exclusion is performed because, by excluding a couple of variables, the sample was increased substantially and precision of estimations enhanced. Moreover, note that the variables in the index are not exactly the same as for the model with all health variables. Prefixes *diff* stand for difficoulty while the suffixes refer to walking 100 meters, sitting for more than 2h, getting up from a chair, climbing stairs, kneeling, raising arms, pulling and lifitng large objects, and picking a small coin from a table, respectively.

[7]The method is wired into several STATA commands and works according to the following formula: 100*(i-0.5)/n) where i is the rank and i is the number of values.

Table 5: **First Principal Components**

	Wave1	Wave2	Wave4	Wave5	Wave6
diff_ walk	0.2950	0.2807	0.2854	0.2868	0.2868
diff_ sitt	0.2147	0.2294	0.2434	0.2440	0.2185
diff_ chair	0.2593	0.2877	0.2966	0.2898	0.2854
diff_ stair	0.2903	0.2832	0.2904	0.2843	0.2893
diff_ kneel	0.2893	0.2813	0.3013	0.2846	0.3047
diff_ arms	0.2209	0.2469	0.2254	0.2728	0.2461
diff_ pull	0.2952	0.2842	0.2914	0.2964	0.2899
diff_ lift	0.3001	0.2988	0.3090	0.2996	0.2855
diff_ coin	0.1961	0.1772	0.1267	0.2175	0.1660
ADLany	0.2814	0.2563	0.2386	0.2594	0.2456
health_ fair	0.1179	0.0977	0.1181	0.1010	0.1454
health_ poor	0.2607	0.2606	0.2564	0.2255	0.2518
heartat	0.1375	0.1513	0.1329	0.1235	0.1262
highblpr	0.1193	0.1296	0.1392	0.1364	0.1410
stroke	0.1363	0.1141	0.0840	0.1066	0.1133
diabetes	0.1269	0.1302	0.1236	0.1014	0.1274
lungdis	0.1230	0.1371	0.1253	0.0981	0.1144
cancer	0.0486	0.0609	0.0827	0.0574	0.1154
bmi	0.0933	0.1052	0.1192	0.0969	0.1244
eurod	0.2538	0.2636	0.2436	0.2479	0.2439
doc_ cont	0.2178	0.2153	0.2378	0.2052	0.2163
nurse_ home	0.0177	0.0434	0.0181	0.0579	0.0204
N	2,066	2,315	2,655	3,444	2,560

instead of the 50th increases the probability of being active (employed) by 10% (23%) and 13% (17%) for men and women respectively. Using the second specification of the index, by 11% (27%) and 12% (16%) for men and women respectively, ceteris paribus.

Overall, as summarized in Table 8, spare work capacity is found in both specifications. It is higher for men than for women and increases with age. Since data are pooled, this difference might be partially driven by the substantial change in participation rates among women not directly related to health.

Robustness and Other Specifications

To check for robustness of the estimation process model (1) is also estimated (i) using a different definition of the dependent variable. This is implemented by substituting individuals that are capable of work, with individuals that are effectively employed (results only are reported in 6th and 10th columns of Table 8.) Spare work capacity is also found here, however, the magnitude is lower than with participation rates. In some sense, the results are more conservative since they are based on the ones who effectively work not assuming that an individual who is actively looking for work can work. Moreover, (ii) the model (for participation as the dependent variable) is estimated using binary models (logit and probit) to explore if results from the LPM model are credible, given that the dependent

Table 6: **Regression Model With All Variables**

	All_Male	All_Female	All_Male_Empl.	All_Female_Empl.
health_exc	0.0967	0.0794	0.280	0.0699
	(0.134)	(0.0850)	(0.149)	(0.0857)
health_vgood	0.0982	0.0424	0.259	0.0432
	(0.134)	(0.0784)	(0.148)	(0.0792)
health_good	0.0889	0.0401	0.263	0.0294
	(0.133)	(0.0751)	(0.146)	(0.0752)
health_fair	0.0785	-0.0361	0.246	-0.0683
	(0.128)	(0.0727)	(0.142)	(0.0731)
mobility2	0.0371	0.0144	0.0383	0.0109
	(0.0290)	(0.0326)	(0.0365)	(0.0331)
IADLany	-0.0348	-0.0668	-0.0823	-0.116
	(0.0764)	(0.0645)	(0.113)	(0.0647)
ADLany	-0.213*	0.0618	-0.174	0.0959
	(0.102)	(0.0791)	(0.117)	(0.0840)
obese	-0.0831*	-0.0486	-0.105*	-0.0402
	(0.0387)	(0.0449)	(0.0453)	(0.0445)
heartatt	-0.132	-0.240**	-0.294**	-0.261***
	(0.0832)	(0.0830)	(0.0937)	(0.0751)
highblpr	0.0189	-0.0475	0.0556	-0.0394
	(0.0228)	(0.0398)	(0.0311)	(0.0392)
cohlester	-0.0123	-0.0157	0.0534	-0.0149
	(0.0253)	(0.0449)	(0.0345)	(0.0447)
stroke	-0.0493	-0.281*	-0.152	-0.225
	(0.111)	(0.133)	(0.136)	(0.136)
diabetes	-0.130	-0.0291	-0.155	-0.0204
	(0.0687)	(0.0787)	(0.0790)	(0.0745)
lungdis	-0.0622	-0.0288	-0.0284	0.0299
	(0.0699)	(0.106)	(0.0907)	(0.105)
cancer	-0.134	-0.0343	-0.216	-0.00213
	(0.154)	(0.0746)	(0.166)	(0.0726)
smokecurr	0.0437	-0.00752	0.0314	0.000900
	(0.0279)	(0.0458)	(0.0378)	(0.0459)
eurod	0.00439	0.00106	-0.0208*	-0.00266
	(0.00658)	(0.00652)	(0.00832)	(0.00660)
smokerform	-0.00547	0.0117	-0.00301	0.000614
	(0.0289)	(0.0406)	(0.0375)	(0.0411)
osteopor	-0.00150	-0.0281	-0.0417	-0.0561
	(0.0945)	(0.0599)	(0.136)	(0.0606)
educ_hs	0.0299	0.161***	0.0706	0.173***
	(0.0297)	(0.0405)	(0.0411)	(0.0399)
educ_collegemore	0.0463	0.436***	0.152***	0.460***
	(0.0340)	(0.0454)	(0.0455)	(0.0458)
hhsize	0.0142	-0.0304*	0.00879	-0.0273
	(0.00899)	(0.0138)	(0.0133)	(0.0140)
partnerinhh	-0.000565	-0.0898*	0.108*	-0.0422
	(0.0271)	(0.0412)	(0.0453)	(0.0427)
_cons	0.772***	0.605***	0.441**	0.532***
	(0.140)	(0.0962)	(0.158)	(0.0968)
N	818	1281	818	1281
adj. R^2	0.055	0.104	0.119	0.111

Standard errors in parentheses
Clustered at Individual Level; Sample aged 50-54. Definition of variables in Table 2.
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

***Table 7:* Results Using a Summary Index**

	PVW_Male	PVW_Female	PVW2_Male	PVW2_Female	PVW_Male_Empl.	PVW_Female_Empl	PVW2_Male_Empl.	PVW2_Female_Empl.
PVW_index	0.00101*	0.00135*			0.00239***	0.00173**		
	(0.000416)	(0.000536)			(0.000542)	(0.000538)		
educ_hs	0.0481	0.167***	0.0472	0.168***	0.100*	0.181***	0.0981*	0.182***
	(0.0299)	(0.0402)	(0.0299)	(0.0402)	(0.0410)	(0.0397)	(0.0410)	(0.0397)
educ_collegemore	0.0731*	0.462***	0.0721*	0.462***	0.198***	0.489***	0.196***	0.490***
	(0.0335)	(0.0440)	(0.0335)	(0.0439)	(0.0443)	(0.0443)	(0.0443)	(0.0442)
hhsize	0.00633	-0.0289*	0.00618	-0.0291*	-0.00360	-0.0269	-0.00411	-0.0271
	(0.00898)	(0.0138)	(0.00898)	(0.0138)	(0.0150)	(0.0139)	(0.0150)	(0.0139)
partnerinhh	0.00168	-0.0927*	0.00110	-0.0924*	0.143**	-0.0431	0.142**	-0.0426
	(0.0278)	(0.0413)	(0.0278)	(0.0413)	(0.0478)	(0.0425)	(0.0477)	(0.0425)
index			0.00117*	0.00125*			0.00270***	0.00160**
			(0.000472)	(0.000515)			(0.000609)	(0.000517)
_cons	0.801***	0.517***	0.788***	0.528***	0.484***	0.397***	0.457***	0.411***
	(0.0479)	(0.0623)	(0.0508)	(0.0607)	(0.0672)	(0.0623)	(0.0702)	(0.0608)
N	818	1281	818	1281	818	1281	818	1281
adj. R^2	0.014	0.096	0.015	0.096	0.071	0.101	0.072	0.101

Standard errors in parentheses
Clustered at Individual Level; Sample aged 50-54; PVW2 stands for the Index using ranking over the whole sample. Definition of variables in Table 2.
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

***Table 8:* Latent Work Capacity by Gender for Participation and Employment**

Simulations of Work Capacity (%)									
		Use All Health Variables				Use PVW Health Index			
Age Group	**# Obs**	**Actual % Working**	**Predicted % Working**	**Estimated Work Capacity**	**Estimated Work Capacity (Empl.)**	**Actual % Working**	**Predicted % Working**	**Estimated Work Capacity**	**Estimated Work Capacity (Empl.)**
					MEN				
55-59	1135	71.63	91.04	19.41	17.80	71.63	91.88	20.25	18.42
60-64	1298	32.05	88.72	56.67	52.52	32.05	90.69	58.64	54.49
65-69	1311	5.80	86.32	80.52	69.66	5.80	89.15	83.35	72.52
70-74	1159	1.81	84.04	82.23	68.16	1.81	87.79	85.98	72.40
					WOMEN				
55-59	1548	41.02	56.26	15.24	15.14	41.02	56.83	15.81	15.68
60-64	1653	12.04	53.30	41.26	37.32	12.04	54.72	42.68	38.79
65-69	1547	2.00	49.82	47.81	42.27	2.00	52.41	50.41	44.85
70-74	1290	0.47	46.43	45.97	39.53	0.47	50.62	50.15	43.75

variable is binary. Results here do not vary substantially.[8] Furthermore, always for robustness checks, the counterfactual rate is constructed using a different methodology (iii). Contrary to averaging out the predicted probabilities in each subgroup, the rate is constructed by using different thresholds as a decision rule above which the individual is predicted to work and under which it is not predicted to work. If the probability of working is predicted to be 0.5 or above, the individual is assumed to be working. Of course, the choice of the threshold, in this case, is a purely arbitrary one that has profound implications for the final result. Hence, the model is estimated using three different thresholds 0.5, 0.6 and 0.8. While the results for 0.6 and 0.5 are lower than in the original model they too find substantial spare work capaicty as in the original method. The threshold of 0.8 does lead to significantly lower and often negative latent work capacity (see A.3).

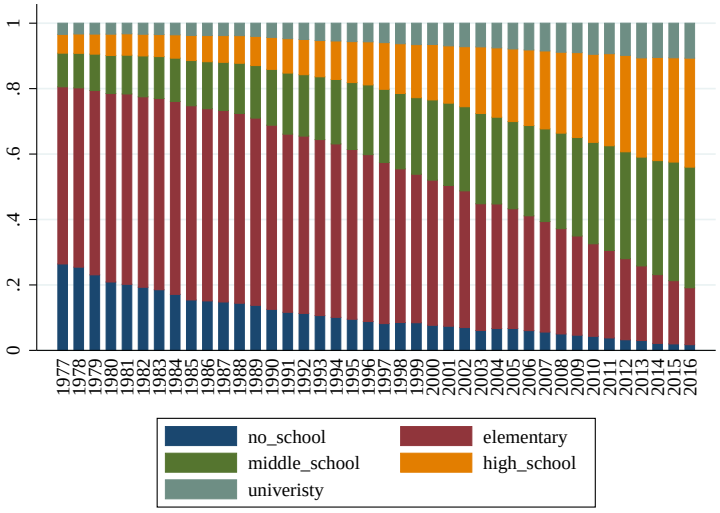
[8]Full results for the logit and probit models are reported in the A.3.

Furthermore, one concern is endogeneity: This is the case if participation has a causal effect on health i.e. retiring, for instance, worsens health (in case of employment status it would be even more problematic!). The papers followed in this work, while acknowledging the problem, seem not to be worried about it. Citing various studies finding mixed evidence (Charles, 2002; Bound and Waidmann, 2007; Johnston and Lee, 2009), Coile et al. (2016) conclude: *"Unfortunately, without more clarity from the literature it is difficult to sign the potential bias from ignoring this potential endogeneity. Estimating the causal effect of retirement on health is a fruitful area for future work."*

Regressions by Educational Group

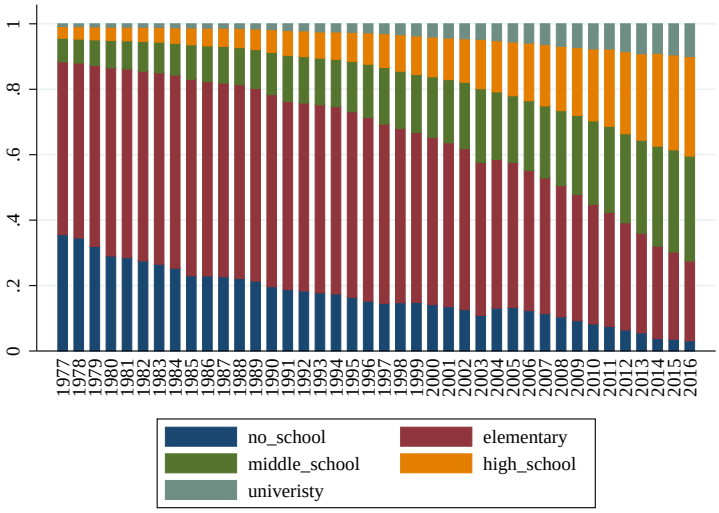
As noted by García-Gómez et al. (2016) education is correlated with health and mortality. Therefore, trends in self-assessed health and mortality can be driven by changes in educational attainment. Changes that have been considerable, as can be inferred from Figure 9 and Figure 10 where the dramatic rise in education for both men and women (see subsection A.3 for figures by repartition) is evident. Similar to Figure 4 a visual inspection of SAH, however, dividing the population into education quartiles for each year and gender was carried out. From this preliminary inspection only extremely small differences appear among different quartiles: Higher educated individuals neither seem to assess health systematically better nor is there a substantial increase over time compared to the least educated quartile. A closer analysis is necessary.

Figure 9: **Educational Attainment for Males Aged Above 50 by Year**



Source: Author's own computations based on Italian Labour Force Survey.

Figure 10: **Educational Attainment for Males Aged Above 50 by Year**



Source: Author's own computations based on Italian Labour Force Survey.

As mentioned before,estimations from methods implemented here, reflect population averages and may hide considerable heterogeneity in spare work capacity. Individuals that are less educated and thus are presumably of a lower SES, may have less potential to expand their work lives since they are in worse health or have jobs where activity is more sensitive to health status. For the Milligan–Wise analysis, it is not possible to inquire into how the participation–mortality relationship has been changing over time by education group or income group because Italian data do not provide the information. For the Cutler et al. method, however, the same regression models as above, separated by educational attainment, can be estimated to find out if, despite the visual inspection, there are differences in latent work capacity. In this case, given the otherwise too small sample, only two levels of education are used: education less and education above high school level. Results are summarized in Table 9 for men and women using respectively a single regression and regressions by education group. Overall, using different models leads to consistent results. Except for the first age-group in which more educated people i.e. the ones with a higher SES, display more capacity to work at older ages.

Table 9: **Latent Work Capacity According to Different Specifications**

Work Capacity by Education (Results only) in %								
	Men				Women			
Education	Single regression		Regression by Educational Group		Single regression		Regression by Educational Group	
	All	PVW Index	All	PVW Index	All	PVW Index	All	PVW Index
				Age 55-59				
Low Education	25.31	26.06	24.69	25.71	19.32	20.58	19.95	21.41
Medium/High Edu.	17.56	18.43	17.39	18.56	13.17	13.39	13.25	13.80
				Age 60-64				
Low Education	56.15	58.08	55.76	57.10	35.84	37.86	36.24	38.66
Medium/High Edu.	56.95	58.94	57.28	59.09	46.29	47.15	46.23	47.09
				Age 65-69				
Low Education	77.84	80.86	78.40	79.28	39.48	42.82	39.63	43.30
Medium/High Edu.	82.57	85.25	82.28	85.58	60.62	62.06	60.42	61.76
				Age 70-74				
Low Education	80.33	84.24	80.69	82.30	38.83	43.42	37.67	43.45
Medium/High Edu.	84.78	88.31	84.94	88.63	61.02	64.35	61.99	65.30

5 Comparison of Results

Having determined that Italians hold considerable latent work capacity, this section first compares results from the Milligan-Wise and the Cutler et al. methods for Italy. In a second step, Italian results are juxtaposed to estimates for other developed countries. The countries of comparison are: Spain, the U.S., the Netherlands, and the UK. Results are comparable, since all the analyses have been performed using the same methodology.

Table 10 represents the results from the different methods for Italy. For the age group 55-59 results from both methods are similar while for older age groups the first method used gives lower results. Comparisons for females are not possible. Moreover, one can also notice that Milligan-Wise estimates vary at 55-59 age group depending on the specification used, while for the Cutler et al. method the estimates diverge at older ages. This reflects some differences in construction of the counterfactual rates.

Table 10: **Comparison Latent Capacity for Male Italians in %**

	Milligan-Wise		
	Age 55-59	**Age 60-64**	**Age 65-69**
Pariticipation	13	43	63
Employment	20	46	62
Cutler et al.			
Participation All	19	57	80
Employment All	18	53	70
Participation Index	20	59	83
Employment Index	18	55	72

Table 11 and Table 12 summarize findings from other papers. Note that for the Milligan-Wise method the years of comparison are crucial. Overall, for males above 60 years, results are most similar to the Netherlands, while Italian males seem to enjoy extraordinary latent work capacity at younger ages. For females, the Netherlands also seem to be the closest match.

Even here, younger individuals have substantially more latent employment capacity than their foreign peers.

Table 11: **Comparison Results Milligan-Wise from Italy to Other Countries in Years**

	Base-Year	**Year of Comaprison**	**Work Capacity in Years**
Italy	2016	1977	5.97/6.43*
US	2010	1977	4.2
UK	2010	1975	6*
Spain	2010	1976	7.8
NL	1981	2010	3.47

Source: Author's own computations and respective papers.
*Note: Italian results are reported for both participation and employment rate. * indicates the use of employment rates.*

Table 12: **Comparison Results Cutler et al. from Italy to Other Countries in %**

	Men				**Women**			
	Age 55-59	**Age 60-64**	**Age 65-69**	**Age 70-74**	**Age 55-59**	**Age 60-64**	**Age 65-69**	**Age 70-74**
Italy	18/18	52/55	70/73	68/72	15/16	37/39	42/45	40/44
US	4/4	18/17	34/31	41/39	5 /4	19/18	33/29	41/37
UK	6	25	56	65	8	38	57	63
Spain	7/5	29/26	61/59	64/62	7/7	20/21	36/36	34/36
NL	8/8	48/47	79/77	78/77	10/10	36/35	56/55	54/51

Source: Author's own computations and respective papers.
Note: Results are reported calculated with employment and not participation rate. The second number refers to the results estimated with PVW indices.

6 Conclusion

The Italian public pension system has seen several reforms over the past 25 years, aimed at increasing effective retirement age. One of the most defining features of these reforms *(Fornero-Monti)* was a link of pension retirement age to life expectancy, implying that working careers could be be extended. Critics of these reforms have been sustaining that work beyond a certain age was not possible due to health deterioration. Both methods implemented here suggest substantial additional work capacity especially if considering men and higher educated i.e. with a higher SES individuals. Thus, in light of the analysis here, the critique that pensionable age should not be increased due to health reasons does not hold. In other words, if the main concern of policymakers is that people's health is the main reason why retirement age cannot be increased, the concern is not relevant. From the perspective of health-and *only* from this perspective- elderly people could work longer.

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A Supplementary Appendix

This extra appendix contains some additional material referred to in the main text which is not absolutely essential for following the reasoning of the paper i.e. robustness checks, sensitivity analyses etc. The additional material is divided according to the sections in the paper.

A.1 Section Nr.2-Trends in Labour Participation and Health

Construction of the Labour Force Participation Rate and Employment Rate

As mentioned in the paper, labour force and employment rates were constructed manually from raw data of the Labour Force Survey carried out by ISTAT. The construction posed some challenges as the variables of the approximately 150 datafiles where not coded homogeneously. Moreover, the variables indicating employment status changed three times. The variable used for calculating the labour force participation rate was constructed as follows. A value equal to 1 stands for participation, 0 otherwise.

***empl_ stat11* is the variable for 1977–1999**

Occupato (Employed) = 1

In cerca di nuova occupazione (In search for a new occupation) = 1

In cerca di prima occupazione (In search for the first occupation)= 1

Servizio di leva (military draft)= 1

Casalinga (Homekeeper) = 0

Studente (Student) =0

Inabile al lavoro (Unable to work) =0

Ritirato dal lavoro (Retired from work) = 0

Altra condizione (Other Condition) =0

***empl_ stat12* for 1992–2004Q1**

Occupato (Employed) =1

Non occupato (Not employed):

Disoccupato alla ricerca di una nuova occupazione (Unemployed, in search for a new

occupation) =1

In cerca di prima occupazione (In search for first occupation) = 1

Inizierá un'attivit in futuro (Will start an activity in the future) =1

Casalinga (Homekeeper) =0

Studente(Student) =0

Ritirato/a dal lavoro (Retired form work)=0

Inabile al lavoro (Unable to work) =0

In servizio di leva o servizio civile sostitutivo (Military draft or substitute civil service) =1

Altra condizione (Other condition) =0

Employment10 **is the variable for 2004Q2–2016**

Occupati (Employed) =1

Persone in cerca, con precedenti esperienze, ex–occupati (Persons in search, with experience, former employed) =1

Persone in cerca, con precedenti esperienze, ex–inattivi (Persons in search, with experience, former inactive) =1

Persone in cerca, senza precedenti esperienze (Persons in search, without former experience) =1

Inattivi in etá lavorativa, cercano non attivamente ma disponibili (Inactive in working age, are searching non actively but disposable)=1

Inattivi in etá lavorativa, cercano ma non disponibili (Inactive in working age, are searching but not disposable) =1

Inattivi in etá lavorativa, non cercano ma disponibili (Inactive in working age, not searching but disposable) =0

Inattivi in etá lavorativa, non cercano e non disponibili (anche militari di leva e inabili al lavoro) (Inactive in working age, not searching and not disposable (also drafted military and unable to work)) =0

Inattivi in etá non lavorativa, meno di 15 anni (Inactive not in working age, less than 15 years) =0

Inattivi in etánon lavorativa, pi di 64 anni (Inactive not in working age, more than 64 years) =0

Several ways of summarizing the variable above into a binary variable have been tested until reaching the configuration depicted above. The reasoning was guided by economic theory and, in addition, by the comparison to some official rates form the OECD, that, however, are available only at a more aggregate level than the ones required for this work. Especially, the decision how handle the different types of *"inactive"* and *"other"* in light of this work is

intricate.

Finally, note that not all the subcategories have the same relevance for the sample of elderly individuals. For instance, getting drafted at the age of 50 is very unlikely.

Division by Repartitions

The 20 administrative districts (*regioni*) are grouped according to their geography, which roughly reflects also differences of socio-economic indicators. This layer of analysis is carried out due to the, in some cases, pronounced differences between the North and the South of the country.

Regions put under the repartition North include: Piemonte, Valle d Aosta, Lombardia, Trentino-Alto Adige, Veneto, Friuli-Venezia Giulia, Liguria, Emilia Romagna.

Regions of the Center are: Toscana, Umbria, Marche, Lazio, Abruzzo

The South is composed of: Molise, Campania, Puglia, Basilicata, Calabria, Sicilia, Sardegna.

Labour force participation rates are depicted in Figure 11 and Figure 12

Death rates by Repartition

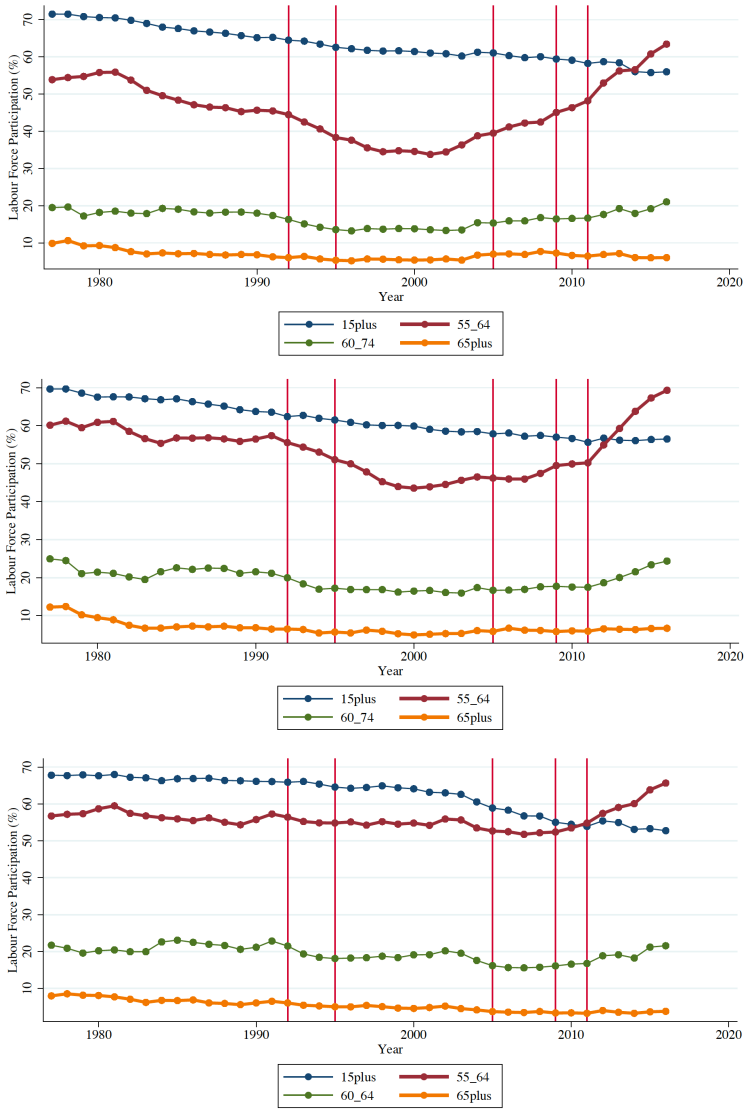
Figure 13 summarizes death rates by repartitions. there are no substantial differences to be observed for an individual save the slightly higher rates in the past in the North.

Self Assessed Health by Repartitions

The SAH health presented above for Italy, is divided here according to repartitions. Even in this case data are grouped by year–groups to enhance the precision of the estimates.

Generally SAH decreases with age in all three repartitions. In the North compared to the other repartitions SAH at older ages seems slightly better across years. While in the South there have been the greatest changes from 1993 to 2003 in improvements of health and then in worsening. This trend is much less evident for the North.

Figure 11: **Participation Rates for Males, North, Center and South**



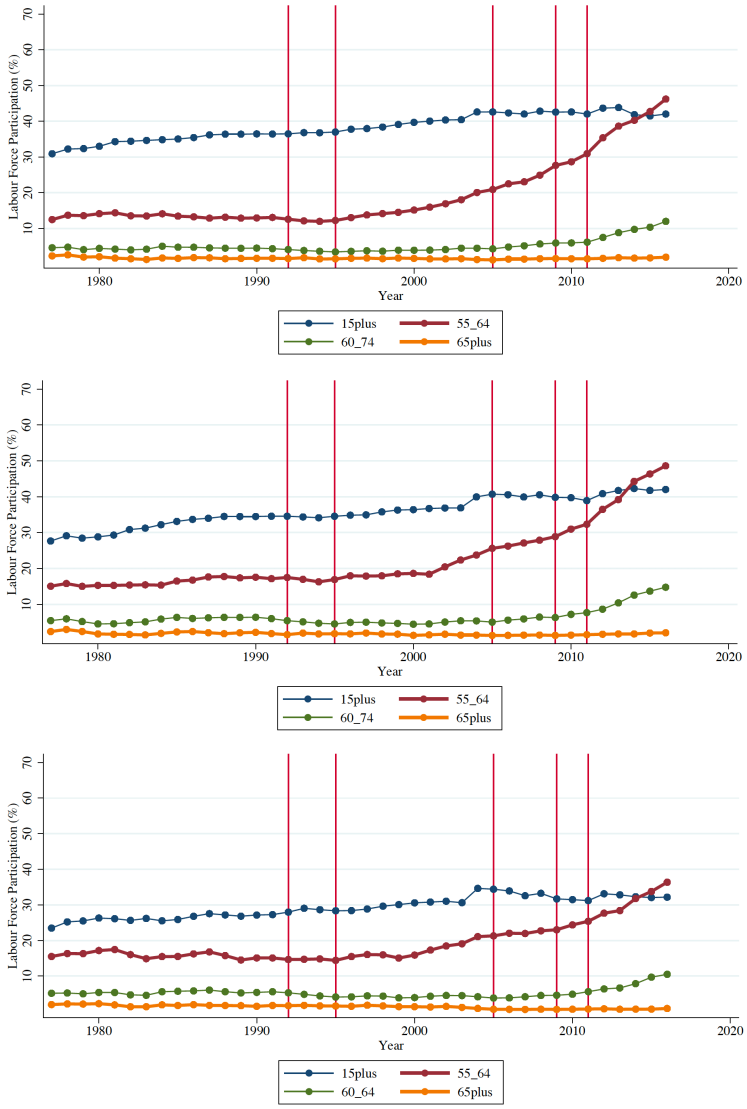
Source: Author's own computations based on the Italian Labour Force Survey.

A.2 Section Nr.3-Milligan Wise Method

Different Death Rate Sources for an Individual Aged 62

As mentioned in the main text, different sources of mortality rates have been tested in the Method. Figure 15 shows the mortality rate for a 62 year old male from ISTAT (death_ all_ mean and death_ italia) and the Mortality database (Mortality Rate) which all refer to rates at a national level. Additionally, there are rates from ISTAT which refer to repartitions. In the last years there has been a convergence in all the rates meaning that, in the spirit of this analysis, there has been a convergence in health across geographical areas. As can be further inferred from Figure 15, the North made the most substantial gains in mortality over the

Figure 12: **Participation Rates for Females, North, Center and South**



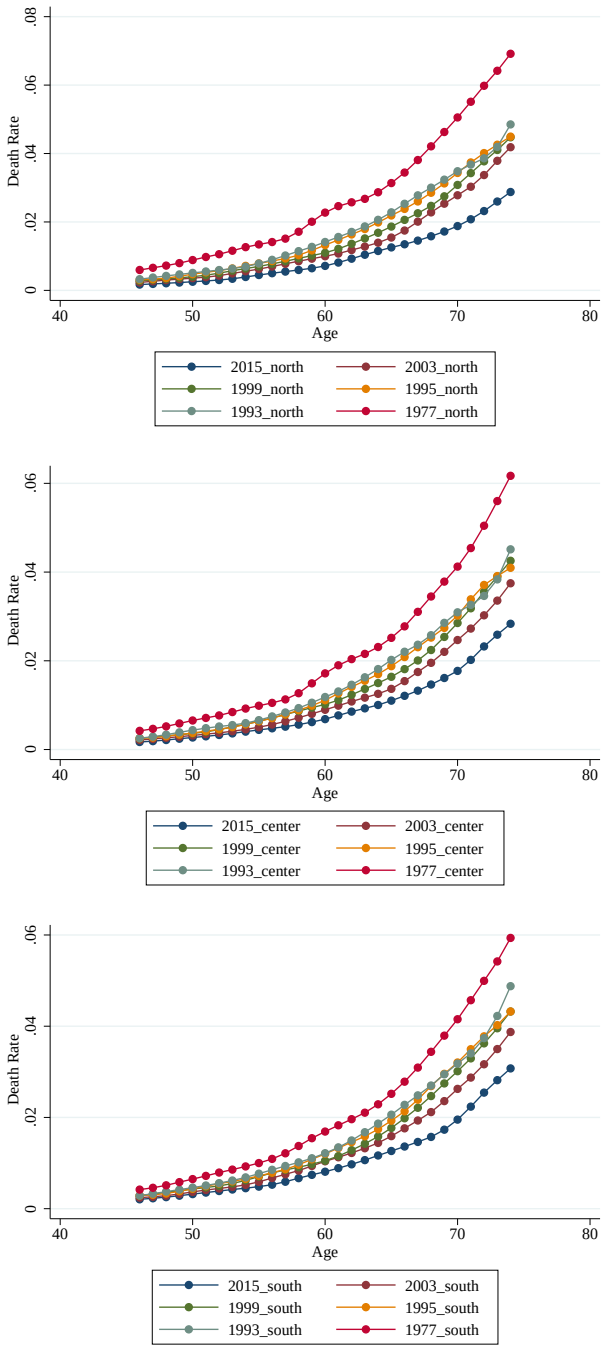
Source: Author's own computations based on the Italian Labour Force Survey.

time period, while the trend for the South is somewhat flatter.

Latent Work Capacity by Repartition

Here latent work capacity is computed using death and participation rates calculated by repartitions. Overall, there are no big differences among North and South if 2016 is compared to 1977. If something, the North seems to have slightly higher latent work capacity. What is, however, interesting, is the different dynamic across ages. If considering the model with participation rates in Table 13, one notices the following: in 1977 compared to the other repartitions the North has the highest participation rate across practically all ages. This changes in 2016 where the Center has the highest one, with some exceptions at some ages.

Figure 13: **Death Rates For Males Aged Above 45 for Selected Years, North, Center, South, by Age**

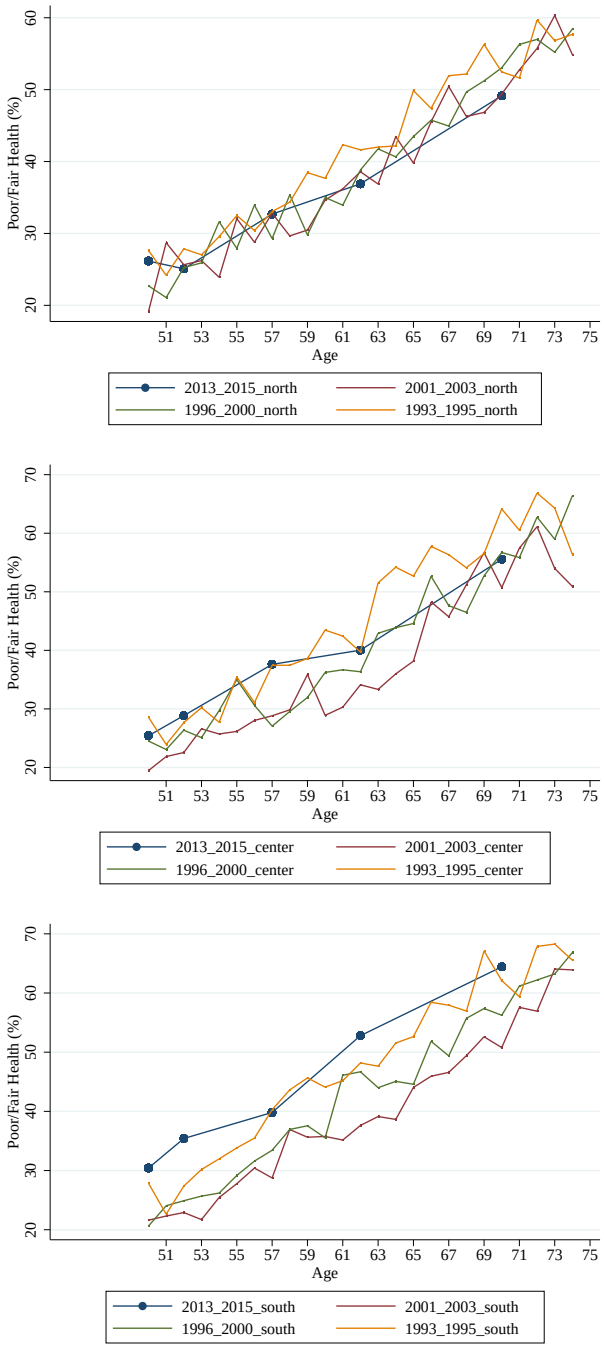


Source: ISTAT.

Moreover, Comparing the North to the South the tables report that from age 55-58 the North has considerable higher rates than the South in 2016. This changes until age 66 where the North outperforms the South implying that individuals in the North have a high participation rate but then suddenly retire, while in the South the phase of retiring is less abrupt.

The slightly higher latent work capacity in the North is driven by lower health but high

Figure 14: **SAH Health Males Aged above 50, North, Center, South**



Source:Author's own computations based on the Italian Household Survey.

participation rates in 1997: Northerners worked more and with worse health and now are in better health and retire after a certain age.

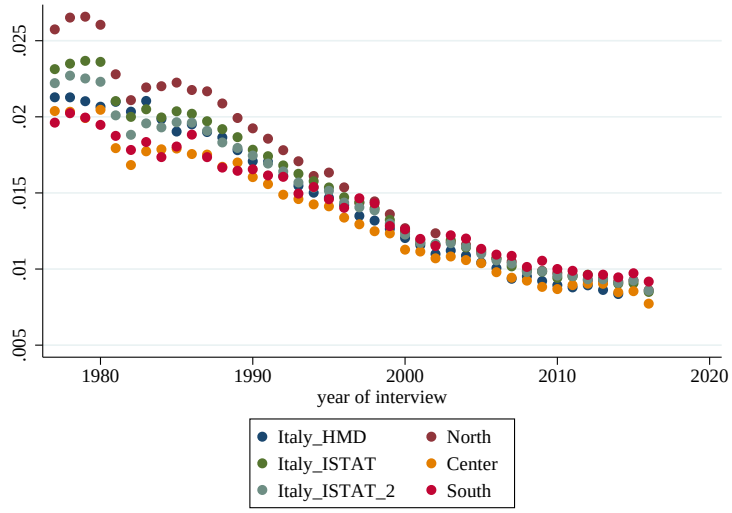
Latent Work Capacity Milligan-Wise with Employment Rates

On the other hand comparing results in Table 15 i.e. using employment instead of participation rates reveals the following: In 2016 there are huge differences in employment

Table 13: **Latent Work Capacity North, Center and South in %**

Age	Deathrate 2016	Participation Rate 2016	Participation Rate 1977	Difference	Capacity
55	0.41393	90.27	96.52	6.25	
56	0.47574	89.02	96.52	7.50	
57	0.54008	84.94	96.52	11.57	
58	0.60701	74.98	95.89	20.91	
59	0.67548	68.75	96.56	27.81	
60	0.73969	58.90	94.61	35.71	
61	0.79892	51.19	94.21	43.02	
62	0.86175	43.00	92.63	49.63	
63	0.93206	35.48	91.13	55.65	
64	1.01636	29.80	91.13	61.34	
65	1.1308	17.59	87.77	70.18	
66	1.25829	14.11	84.77	70.66	
67	1.37543	11.09	82.57	71.48	
68	1.48289	9.30	74.50	65.20	
69	1.59184	9.79	74.50	64.71	6.62 years
Age	**Deathrate 2016**	**Participation Rate 2016**	**Participation Rate 1977**	**Difference**	**Capacity**
55	0.42061	91.63	95.88	4.25	
56	0.47493	89.12	96.45	7.33	
57	0.52838	86.57	94.58	8.02	
58	0.57737	84.35	93.91	9.57	
59	0.6203	75.88	93.91	18.03	
60	0.66146	69.13	92.22	23.09	
61	0.70882	61.39	93.51	32.12	
62	0.77272	50.64	90.03	39.39	
63	0.8616	43.24	89.44	46.19	
64	0.98864	33.60	83.90	50.29	
65	1.12602	25.90	77.91	52.01	
66	1.23421	17.22	72.98	55.76	
67	1.31045	9.15	72.98	63.83	
68	1.38029	10.88	72.98	62.10	
69	1.50496	11.59	65.08	53.49	5.25 years
Age	**Deathrate 2016**	**Participation Rate 2016**	**Participation Rate 1977**	**Difference**	**Capacity**
55	0.49878	83.70	94.14	10.44	
56	0.5351	83.57	94.14	10.57	
57	0.57616	78.00	94.37	16.37	
58	0.62636	80.27	91.01	10.74	
59	0.68056	74.04	91.01	16.97	
60	0.74878	65.64	88.54	22.91	
61	0.83129	59.58	86.01	26.42	
62	0.91754	50.00	82.66	32.66	
63	1.01435	45.44	80.24	34.80	
64	1.12812	34.51	77.93	43.42	
65	1.25087	18.15	74.49	56.34	
66	1.37664	12.44	67.75	55.31	
67	1.47514	7.31	62.57	55.25	
68	1.54969	5.49	62.57	57.07	
69	1.66388	4.38	52.27	47.89	4.97 years

Figure 15: **Death Rates for an Individual Aged 62**



Source: ISTAT, Mortality Database

rate from age 55-57 where the North is much more employed. From age 60 onwards the South is more employed. This means that there is a lot of unemployment in the South compared to the North but the ones which have a job do work longer. From age 66 onwards there is another change in trend as for participation rate above: the North surpassing the South in terms of employment. When comparing the Center to the other repartitions, people here are the most employed at older ages, especially when comparing to the South.

In 1977 Individuals in the North have a higher employment rate that in the South an center throughout all the ages with tendency of widening gap as age advances.

In sum, again, the North has a slightly higher capacity to work because in the past more people with worse health worked compared to the other repartitions. however, the differences are not substantial.

A.3 Section Nr.4-Cutler et al. Method

Results by Using a Different Method for the Construction of Counterfactual Rates

The counterfactal rate in the main text above is constructed by simply averaging out the probability of participating by age and gender resulting from the out-of-sample prediction in Equation 1. For instance, all the predicted probabilities for 55–59 year old males are averaged

Table 14: **Latent Work Capacity using Employment instead of Participation in %**

Age	Deathrate 2016	Employment Rate 2016	Employment Rate 1977	Difference	Capacity
55	0.43709	80.46	95.02	14.56	
56	0.48647	80.06	94.32	14.26	
57	0.53774	75.04	94.35	19.31	
58	0.58863	70.51	93.21	22.71	
59	0.64128	64.38	93.21	28.84	
60	0.70238	56.29	92.77	36.48	
61	0.7701	50.12	90.39	40.27	
62	0.84989	41.38	89.78	48.40	
63	0.93752	36.11	88.67	52.56	
64	1.04084	28.90	83.50	54.59	
65	1.16445	18.96	81.29	62.33	
66	1.29968	14.26	77.96	63.70	
67	1.40058	9.63	74.42	64.80	
68	1.48336	8.70	68.99	60.30	
69	1.60841	9.01	68.99	59.98	6.43

out in order to obtain the counterfactual rate.

Yet, there are different possible methods for predicting the rate. One of them is to interpret the predicted probability as the probability of participating in the labour market. The main drawback with this method is that a purely arbitrary threshold is needed to determine if the individual should be counted towards the active or not. One might say that a predicted probability higher than 0.6 is such a shed: All probabilities above that are counted as participating, while all below as not participating.

Figure 16 summarizes the results from such an estimation with the thresholds 0.5, 0.6, 0.8 graphically. Spare work capacity is the difference between two respective lines. For instance, if the predicted line lies above the actual, latent capacity is found. Substantial latent Work Capacity is found even here. However, especially for males to a much lager extent than for the other method. For females results are more in line. This holds true for the 0.5 and also 0.6 threshold, where, however, latent capacity at younger ages is not found. For the 0.8 thresholds results differ.

Regression Outputs From the Logit and Probit Tables

Equation 1 is also estimated using a probit and logit model. Table 16 and Table 17 summarize regressions outputs for the basic models while Table 18 and Table 19 for the estimation divided by educational level.

Latent Work From the Logit and Probit Models

Table 15: **Latent Work Capacity using Employment instead of Participation North, Center and South in %**

Age	Deathrate 2016	Employment Rate 2016	Employment Rate 1977	Difference	Capacity
55	0.41393	83.05	95.60	12.56	
56	0.47574	84.25	95.60	11.35	
57	0.54008	78.89	95.60	16.71	
58	0.60701	69.55	94.66	25.10	
59	0.67548	62.90	95.74	32.85	
60	0.73969	53.76	93.69	39.93	
61	0.79892	46.95	93.23	46.27	
62	0.86175	38.66	91.55	52.89	
63	0.93206	33.63	90.45	56.82	
64	1.01636	27.91	90.45	62.54	
65	1.1308	17.08	87.01	69.93	
66	1.25829	13.89	84.17	70.27	
67	1.37543	10.88	82.06	71.17	
68	1.48289	9.10	73.82	64.72	
69	1.59184	9.66	73.82	64.16	6.97
Age	**Deathrate 2016**	**Employment Rate 2016**	**Employment Rate 1977**	**Difference**	**Capacity**
55	0.42061	83.10	94.83	11.73	
56	0.47493	81.17	94.99	13.82	
57	0.52838	80.22	92.49	12.27	
58	0.57737	76.06	92.30	16.24	
59	0.6203	69.94	92.30	22.36	
60	0.66146	64.51	90.21	25.70	
61	0.70882	56.69	92.06	35.38	
62	0.77272	47.90	87.90	40.01	
63	0.8616	39.28	88.52	49.24	
64	0.98864	30.96	82.92	51.96	
65	1.12602	24.87	76.91	52.04	
66	1.23421	17.22	72.06	54.84	
67	1.31045	9.15	72.06	62.91	
68	1.38029	10.88	72.06	61.18	
69	1.50496	11.59	64.64	53.04	5.63
Age	**Deathrate 2016**	**Employment Rate 2016**	**Employment Rate 1977**	**Difference**	**Capacity**
55	0.49878	69.58	92.92	23.34	
56	0.5351	68.20	92.92	24.72	
57	0.57616	60.26	92.33	32.07	
58	0.62636	67.05	88.63	21.58	
59	0.68056	62.48	88.63	26.15	
60	0.74878	54.36	87.01	32.64	
61	0.83129	51.61	84.93	33.32	
62	0.91754	41.39	81.10	39.71	
63	1.01435	38.50	78.57	40.07	
64	1.12812	29.41	75.88	46.46	
65	1.25087	17.45	73.52	56.06	
66	1.37664	12.10	65.82	53.72	
67	1.47514	7.31	61.11	53.79	
68	1.54969	5.49	61.11	55.61	
69	1.66388	4.38	51.49	47.11	5.86

Table 16: **Regression Model With All Variables for Males and Females, Logit and Probit**

	All_Male_lg	All_Female_lg	All_Male_pb	All_Female_pb
health_exc	1.381	0.340	0.777	0.215
	(1.200)	(0.404)	(0.555)	(0.246)
health_vgood	1.442	0.163	0.762	0.120
	(1.200)	(0.370)	(0.553)	(0.225)
health_good	1.192	0.154	0.690	0.110
	(1.138)	(0.353)	(0.518)	(0.215)
health_fair	0.963	-0.170	0.612	-0.0955
	(1.023)	(0.343)	(0.476)	(0.209)
mobility2	0.584	0.0742	0.262	0.0524
	(0.496)	(0.153)	(0.225)	(0.0926)
IADLany	-0.260	-0.298	-0.170	-0.176
	(0.838)	(0.290)	(0.430)	(0.177)
ADLany	-1.950**	0.264	-0.990*	0.161
	(0.748)	(0.361)	(0.386)	(0.220)
obese	-1.062**	-0.228	-0.539**	-0.147
	(0.388)	(0.200)	(0.201)	(0.121)
heartatt	-1.227*	-1.147**	-0.705*	-0.707**
	(0.593)	(0.435)	(0.322)	(0.259)
highblpr	0.358	-0.204	0.170	-0.125
	(0.398)	(0.176)	(0.192)	(0.109)
cohlester	-0.237	-0.0825	-0.0679	-0.0437
	(0.394)	(0.204)	(0.191)	(0.125)
stroke	-0.412	-1.421	-0.192	-0.833
	(0.976)	(0.880)	(0.521)	(0.487)
diabetes	-1.077*	-0.160	-0.628*	-0.105
	(0.505)	(0.347)	(0.269)	(0.217)
lungdis	-0.630	-0.124	-0.297	-0.0742
	(0.684)	(0.482)	(0.354)	(0.287)
cancer	-0.991	-0.143	-0.563	-0.0916
	(0.927)	(0.322)	(0.519)	(0.199)
smokecurr	0.834	-0.0191	0.422	-0.0138
	(0.484)	(0.215)	(0.222)	(0.131)
eurod	0.0722	0.00294	0.0327	0.00246
	(0.113)	(0.0300)	(0.0469)	(0.0183)
smokerform	-0.0640	0.0447	-0.0582	0.0348
	(0.415)	(0.192)	(0.202)	(0.117)
osteopor	-0.0489	-0.130	-0.111	-0.0817
	(1.407)	(0.267)	(0.638)	(0.163)
educ_hs	0.382	0.675***	0.197	0.421***
	(0.363)	(0.172)	(0.179)	(0.106)
educ_collegemore	0.790	2.502***	0.364	1.451***
	(0.624)	(0.348)	(0.270)	(0.182)
hhsize	0.243	-0.150*	0.139*	-0.0911*
	(0.138)	(0.0654)	(0.0686)	(0.0397)
partnerinhh	-0.0789	-0.458*	-0.101	-0.274*
	(0.404)	(0.207)	(0.200)	(0.125)
_cons	0.404	0.604	0.306	0.339
	(1.343)	(0.462)	(0.615)	(0.279)
N	818	1281	818	1281

Standard errors in parentheses
Clustered at Individual Level
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 17: **Regression Model Health Index for Males and Females, Logit and Probit**

	PVW_Male_lg	PVW_Female_lg	PVW2_Male_pb	PVW2_Female_pb
PVW_index	0.0145**	0.00616*	0.00694*	0.00374*
	(0.00560)	(0.00243)	(0.00274)	(0.00149)
educ_hs	0.581	0.688***	0.296	0.429***
	(0.329)	(0.169)	(0.169)	(0.105)
educ_collegemore	1.108	2.597***	0.536*	1.505***
	(0.582)	(0.340)	(0.267)	(0.180)
hhsize	0.0961	-0.141*	0.0524	-0.0864*
	(0.134)	(0.0641)	(0.0683)	(0.0391)
partnerinhh	-0.00372	-0.458*	-0.00485	-0.277*
	(0.385)	(0.202)	(0.196)	(0.123)
_cons	0.927	0.170	0.642*	0.1000
	(0.520)	(0.287)	(0.270)	(0.175)
N	818	1281	818	1281

Standard errors in parentheses
Clustered at Individual Level; Age 50-54
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 18: **Regression Model All variables by Educational Group for Males and Females, Logit and Probit**

	All_Male_low_lg	All_Male_mid_lg	All_Female_low_lg	All_Female_mid_lg	All_Male_low_pb	All_Male_mid_pb	All_Female_low_pb	All_Female_mid_pb
health_exc	0	2.276	0.0952	0.607	0	1.208	0.0806	0.379
	(.)	(1.284)	(0.703)	(0.478)	(.)	(0.640)	(0.446)	(0.294)
health_vgood	-16.88***	2.544	-0.0950	0.503	-5.056***	1.299*	-0.0356	0.321
	(2.569)	(1.343)	(0.625)	(0.448)	(1.170)	(0.649)	(0.393)	(0.276)
health_good	-17.92***	2.654*	-0.133	0.356	-5.477***	1.378*	-0.0617	0.234
	(2.594)	(1.216)	(0.572)	(0.432)	(1.067)	(0.609)	(0.362)	(0.267)
health_fair	-19.99***	3.593**	-1.074	0.106	-6.677***	1.875**	-0.638	0.0778
	(2.665)	(1.184)	(0.557)	(0.419)	(1.110)	(0.582)	(0.349)	(0.259)
mobility2	0.118	0.899	0.778*	-0.0433	0.111	0.393	0.475*	-0.0237
	(0.899)	(0.677)	(0.368)	(0.164)	(0.486)	(0.284)	(0.220)	(0.0999)
IADLany	-0.924	0.335	-1.128*	0.105	-0.548	0.0378	-0.677*	0.0735
	(1.416)	(1.292)	(0.537)	(0.400)	(0.844)	(0.622)	(0.309)	(0.243)
ADLany	-1.033	-3.142**	0.290	0.356	-0.575	-1.572**	0.155	0.220
	(1.401)	(1.004)	(0.635)	(0.441)	(0.794)	(0.525)	(0.395)	(0.270)
obese	-1.045	-0.879	-0.277	-0.260	-0.587	-0.459	-0.160	-0.162
	(0.843)	(0.524)	(0.381)	(0.207)	(0.443)	(0.253)	(0.225)	(0.127)
heartatt	-0.316	-1.726*	-1.145	-1.305*	-0.213	-0.973**	-0.741	-0.808**
	(1.086)	(0.687)	(0.826)	(0.509)	(0.671)	(0.355)	(0.504)	(0.307)
highblpr	2.076*	-0.109	-0.555	-0.208	1.204*	-0.0386	-0.333	-0.129
	(0.896)	(0.440)	(0.372)	(0.192)	(0.499)	(0.206)	(0.223)	(0.119)
cohlester	1.193	-0.0134	0.176	-0.150	0.644	0.0348	0.112	-0.0912
	(0.950)	(0.447)	(0.425)	(0.222)	(0.531)	(0.214)	(0.262)	(0.137)
stroke	-2.903	-0.636	0	-1.269	-1.484	-0.340	0	-0.773
	(2.043)	(0.878)	(.)	(0.855)	(1.246)	(0.485)	(.)	(0.499)
diabetes	-1.885*	-1.819**	-0.334	-0.282	-1.046*	-0.987**	-0.169	-0.174
	(0.905)	(0.580)	(0.721)	(0.391)	(0.507)	(0.318)	(0.436)	(0.245)
lungdis	-2.591	-1.005	0.733	-0.314	-1.601	-0.475	0.425	-0.183
	(1.588)	(0.779)	(0.942)	(0.486)	(0.956)	(0.402)	(0.567)	(0.296)
cancer	-2.223	0	-0.122	-0.263	-1.272	0	-0.0720	-0.164
	(3.069)	(.)	(0.758)	(0.356)	(1.137)	(.)	(0.465)	(0.220)
smokecurr	0.834	0.758	0.173	-0.0976	0.212	0.394	0.118	-0.0611
	(1.558)	(0.529)	(0.534)	(0.219)	(0.701)	(0.244)	(0.330)	(0.133)
eurod	0.176	-0.0374	-0.0503	0.0115	0.130	-0.0188	-0.0274	0.00721
	(0.202)	(0.113)	(0.0634)	(0.0322)	(0.104)	(0.0493)	(0.0376)	(0.0196)
smokerform	0.530	-0.426	-0.00888	0.0682	0.276	-0.216	-0.0231	0.0438
	(0.982)	(0.500)	(0.487)	(0.187)	(0.540)	(0.234)	(0.302)	(0.114)
osteopor	0	-0.789	-0.369	-0.145	0	-0.488	-0.216	-0.0996
	(.)	(1.637)	(0.535)	(0.302)	(.)	(0.723)	(0.330)	(0.186)
hhsize	-0.190	0.274	-0.159	-0.129	-0.0907	0.153	-0.0958	-0.0801
	(0.274)	(0.196)	(0.125)	(0.0670)	(0.146)	(0.0907)	(0.0762)	(0.0409)
partnerinhh	-0.303	-0.0708	-0.145	-0.652**	-0.176	-0.110	-0.0957	-0.381**
	(0.825)	(0.526)	(0.420)	(0.229)	(0.416)	(0.247)	(0.254)	(0.134)
_cons	20.46***	-0.152	0.811	1.359**	6.906***	0.0584	0.465	0.808**
	(3.375)	(1.377)	(0.765)	(0.513)	(1.336)	(0.684)	(0.475)	(0.313)
N	109	678	266	1013	109	678	266	1013

Standard errors in parentheses
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Spare Work Capacity from the models is summarized in Table 20. Overall, results do not

Table 19: **Regression Model Health Index by Educational Group for Males and Females, Logit and Probit**

	PVW_Male_low_lg	PVW_male_mid_lg	PVW_Female_low_lg	PVW_Female_mid_lg	PVW_Male_low_pb	PVW_male_mid_pb	PVW_Female_low_pb	PVW_Female_mid_pb
PVW_index	0.0153	0.0144*	0.00564	0.00851***	0.00796	0.00676*	0.00351	0.00525***
	(0.00957)	(0.00684)	(0.00461)	(0.00250)	(0.00502)	(0.00325)	(0.00287)	(0.00154)
hhsize	0.107	0.0870	-0.151	-0.116	0.0569	0.0478	-0.0936	-0.0723
	(0.236)	(0.185)	(0.105)	(0.0652)	(0.131)	(0.0876)	(0.0648)	(0.0400)
partnerinhh	-0.0572	0.0250	-0.0521	-0.666**	-0.0485	-0.00134	-0.0362	-0.398**
	(0.750)	(0.498)	(0.335)	(0.223)	(0.417)	(0.241)	(0.207)	(0.131)
_cons	0.896	1.584**	-0.0881	1.016***	0.607	0.989***	-0.0541	0.618***
	(0.830)	(0.569)	(0.448)	(0.273)	(0.450)	(0.286)	(0.280)	(0.164)
N	135	683	268	1013	135	683	268	1013

Standard errors in parentheses
Clustered at Individual Level; Age 50-54; Low Education is below high school
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

differ between the estimation methods and are in line with the LPM model. More latent capacity to work at older ages is found for men compared to women. This might also relate to the underlying strong raise in participation rates for women, which should be born in mind when interpreting the results.

Table 20: **Latent Work Capacity Using Logit and Probit Models for Constrctiong the Participation Rates**

Simulations of Work Capacity (%) Logit							
		Use All Health Variables			**Use PVW Health Index**		
Age Group	# Obs	Actual % Working	Predicted % Working	Estimated Work Capacity	Actual % Working	Predicted % Working	Estimated Work Capacity
				MEN			
55-59	1135	71.63	90.93	19.30	71.63	91.85	20.22
60-64	1298	32.05	87.93	55.88	32.05	90.39	58.34
65-69	1311	5.80	85.04	79.24	5.80	88.55	82.75
70-74	1159	1.81	81.98	80.17	1.81	86.62	84.80
				WOMEN			
55-59	1548	41.02	56.35	15.33	41.02	56.86	15.84
60-64	1653	12.04	53.74	41.70	12.04	54.99	42.95
65-69	1547	2.00	50.39	48.39	2.00	52.80	50.79
70-74	1290	0.47	47.25	46.79	0.47	51.09	50.63

Simulations of Work Capacity (%) Probit							
		Use All Health Variables			**Use PVW Health Index**		
Age Group	# Obs	Actual % Working	Predicted % Working	Estimated Work Work Capaicty	Actual % Working	Predicted % Working	Estimated Work Capacity
				MEN			
55-59	1135	71.63	90.76	19.13	71.63	91.87	20.24
60-64	1298	32.05	87.72	55.67	32.05	90.46	58.41
65-69	1311	5.80	84.60	78.80	5.80	88.70	82.90
70-74	1159	1.81	81.48	79.67	1.81	86.90	85.09
				WOMEN			
55-59	1548	41.02	56.33	15.31	41.02	56.87	15.85
60-64	1653	12.04	53.66	41.62	12.04	54.99	42.95
65-69	1547	2.00	50.26	48.26	2.00	52.80	50.79
70-74	1290	0.47	47.08	46.62	0.47	51.09	50.63

Educational Level by Repartitions

Figure 17 to Figure 18 represent the evolution of educational attainment divided by gender

and repartition for ages above 50. Overall, Italians do not have a high level of education. Especially, if concerning females in the South in the 1970 and 1980: in 1977 over 90% aged above 50 had as a maximum education of primary school! This number plumbed to below 40% (still a high number compared to females in the North, 23%) over 40 years. This is relevant insofar better education is correlated with better health and hence capacity to work.

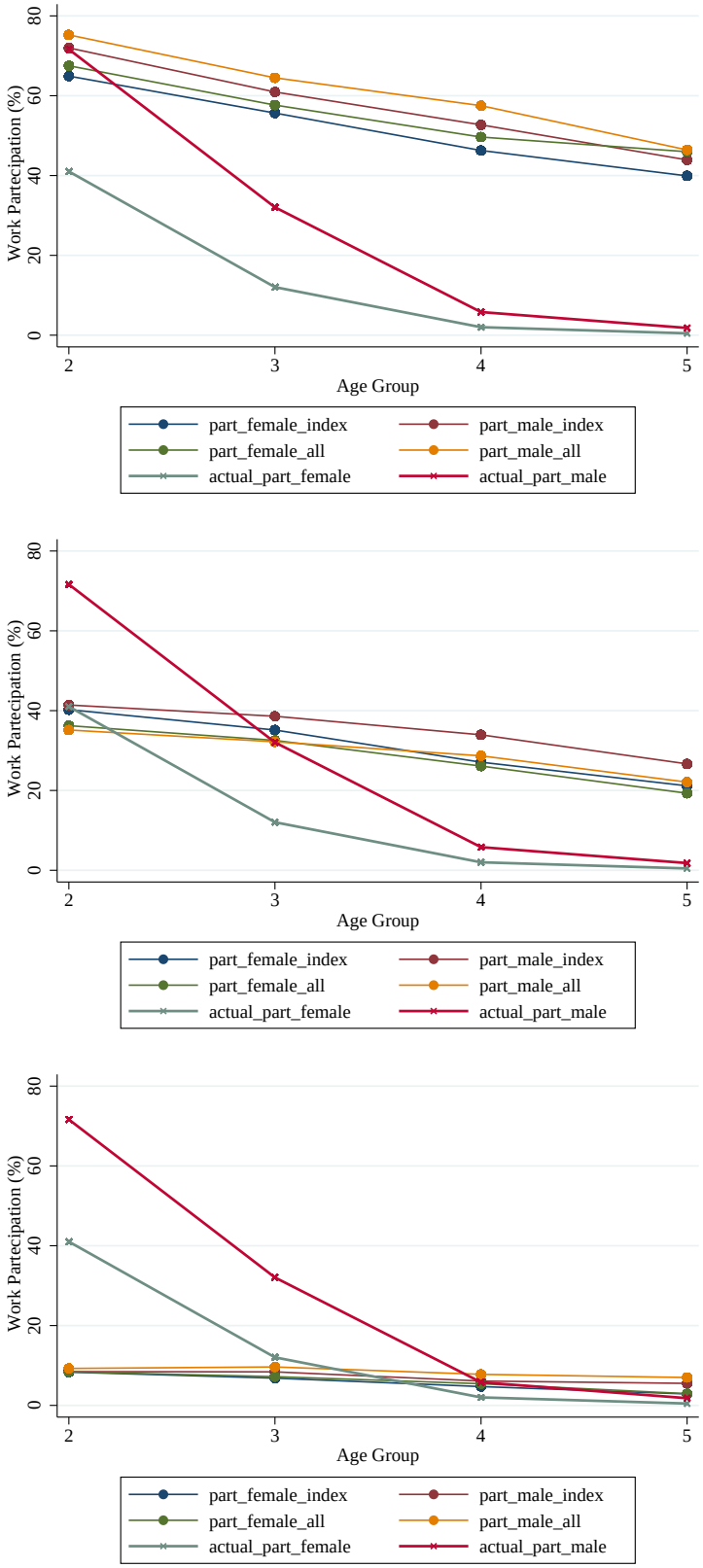
Latent Work From the Cutler et al. Method Estimated Using Probit by Educational Level

As for the Cutler et al. method above, some results of different specifications are presented by educational level. Results are only presented for the probit model. Table 21 shows that latent work capacity is consistent to the different specifications and generally higher for men than for women. This difference might partly be driven by underlying cultural changes. More educated males have generally more capacity to work, the only exception being the ones aged 55-59. This is consistent with the fact that the tasks that are performed by more educated people can be continued for a longer time. Moreover, work capacity increases as males get older. For females similar considerations apply with the inly difference that the gap between more and less educated at older ages is much bigger than for their male counterparts.

Table 21: **Latent Work Capacity According to Different Specifications Using the Probit Model by Educational and Age Groups**

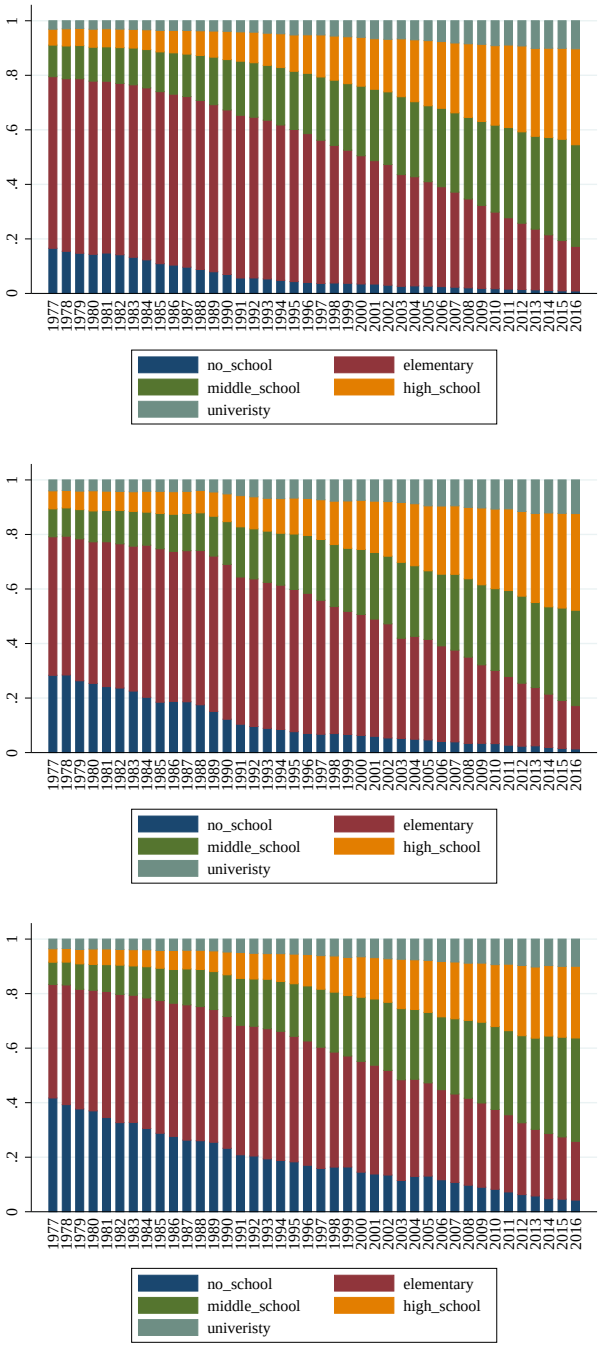
Work Capacity by Education (Results only) in % Probit Model								
	Men				**Women**			
Education	Single regression		Regression by Educational Group		Single regression		Regression by Educational Group	
	All	PVW Index	All	PVW Index	All	PVW Index	All	PVW Index
				Age 55-59				
Low Education	24.49	25.95	21.49	25.69	19.46	20.65	20.82	21.41
Medium/High Edu.	17.45	18.46	16.73	18.56	13.20	13.42	13.23	13.83
				Age 60-64				
Low Education	54.18	57.39	54.38	56.94	36.16	38.09	37.22	38.68
Medium/High Edu.	56.48	58.96	56.08	59.05	46.70	47.47	46.31	46.22
				Age 65-69				
Low Education	74.80	79.69	76.81	79.01	40.01	43.21	40.63	43.31
Medium/High Edu.	81.85	85.34	80.45	85.46	60.93	62.44	60.45	61.95
				Age 70-74				
Low Education	76.71	82.65	79.44	81.85	39.61	43.93	39.39	43.45
Medium/High Edu.	83.63	88.36	82.32	88.42	61.40	64.75	62.11	65.53

Figure 16: **Labour Participation Rates: Estimated vs Actual Using 0.5, 0.6 and 0.8 Threshold**



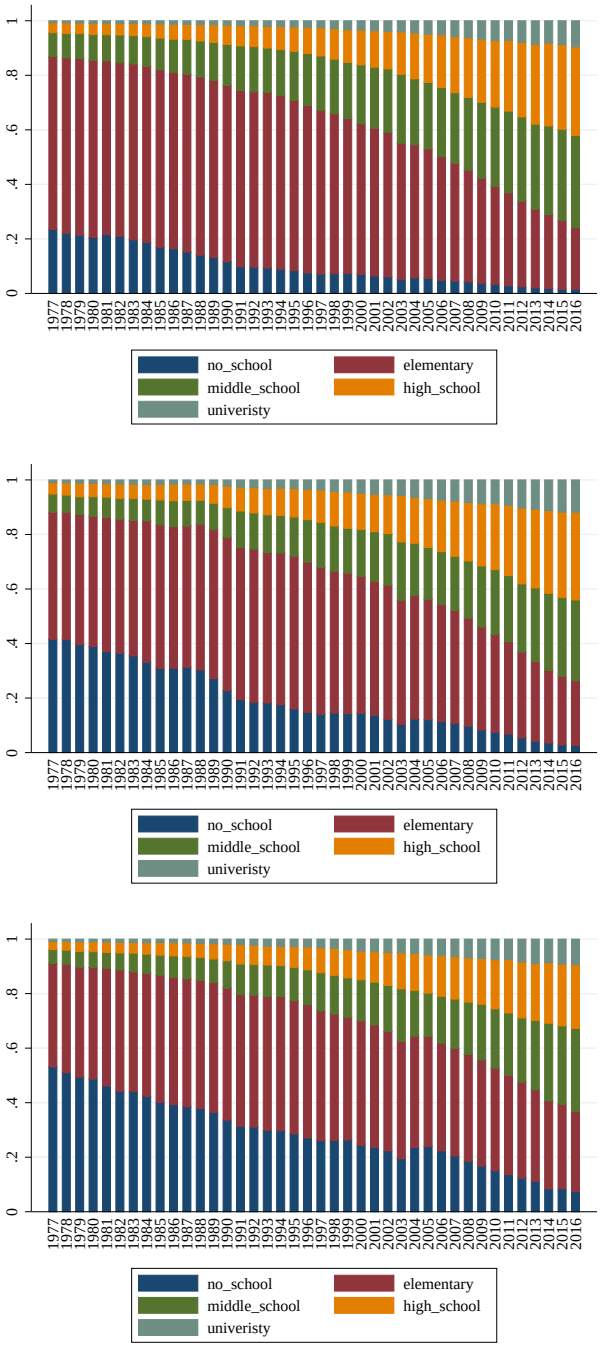
Source: Author's own computations based on the Italian Labour Force Survey. Note: age Group 2 stands for 55-59 old, 3 for 60-64 old etc.

Figure 17: **Educational Attainment for Males Aged Above 50: North, Center, South**



Source: Author's own computations based on the Italian Labour Force Survey.

Figure 18: **Educational Attainment for Females Aged Above 50: North, Center, South**



Source: Author's own computations based on the Italian Labour Force Survey.